CDM-840

Advanced VSAT Series Remote Router
Installation and Operation Manual

For Firmware Version 1.5.1.X or higher

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. Product specifications are subject to change without prior notice.

Part Number **MN-CDM840** Revision 2

Errata A for MN-CDM840 Rev 2

Comtech EF Data Documentation Update

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For Firmware Version 1.5.1.X or Higher

Part Number MN-CDM840
Revision 2

Part Number MN/MBT4000.IOM Revision 4

Subject: Update Section B.2.2, Deleted Occupied Bandwidth data

Errata Part Number: ER-CDM840-EA2 (*Errata documents are not revised)*

PLM CO Number: C-0029457

Comments: See attached page(s). The new information will be included in the next released revision of the manual.

LDPC also uses interleaving to spread the errors. In contrast, Viterbi error correction operates by passing data through the convolutional error correction process using a single error correction pass.

The error correcting capability of LDPC is enhanced by use of large block sizes. Although large block sizes can increase latency in low bitrate applications (typically less than 2Mbps), this is not a drawback in one-way broadcast applications. Links with LDPC normally operate at multi-megabit data rates where latency effects are minimal. The standard block size for LDPC is 64,800 bits and, for lower data rate applications, a short frame block at 16,800 bits suffers only a small error correcting loss (0.2 to 0.5 dB) compared to the standard block.

B.2.1 Range of Data Rates

See* Sect. 1.4 SUMMARY OF SPECIFICATIONS *for the range of available data rates.

B.2.2 BER, QEF, Eb/No, Es/No Spectral Efficiency, and Occupied Bandwidth

Depending on the operating mode, the DVB standard uses different modes of specifying performance with a unit in IF Loop and Additive White Gaussian Noise (AWGN):

- **DVB-S2 standard: "Quasi Error Free" (QEF)** is defined as "less than one uncorrected error-event per transmission hour at the level of a 5 Mbits/s single TV service decoder", approximately corresponding to a Transport Stream Packet Error Ratio equal to a PER<10^{-7} before demultiplexer. A packet is defined as block of 188-byte MPEG frame size data.

- **Es/No vs. Eb/No:** The DVB-S2 standard commonly refers to the use of Es/No instead of Eb/No. When links operate at a constant symbol rate this is a good method for comparing the performance of different modulation types and code rates.

  The relation between the two quantities is given by:

$$\mathbf{Eb/No = Es/No - 10_{log}(Spectral\ Efficiency)}$$

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PREFACE

About this Manual

This manual provides installation and operation information for the Comtech EF Data CDM-840 Remote Router. This is an informational document intended for the persons responsible for the operation and maintenance of the CDM-840.

Related Documents

- *Comtech EF Data ODM-840 Outdoor Remote Router /ODMR-840 Reduced Form Factor Outdoor Remote Router Installation and Operation Manual (CEFD P/N MN-ODM840)*
- *Comtech EF Data CTOG-250 Comtech Traffic Optimization Gateway Installation and Operation Manual (CEFD P/N MN-CTOG250)*
- *Comtech EF Data CDD-880 Multi Receiver Router Installation and Operation Manual (CEFD P/N MN-CDD880)*

Conventions and References

Patents and Trademarks

See all of Comtech EF Data's Patents and Patents Pending at http://patents.comtechefdata.com.

Comtech EF Data acknowledges that all trademarks are the property of the trademark owners.

Warnings, Cautions, and Notes

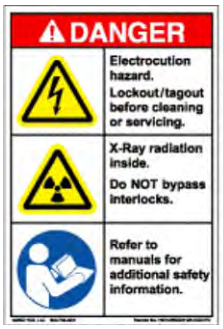
A WARNING GIVES INFORMATION ABOUT A POSSIBLE HAZARD THAT MAY CAUSE DEATH OR SERIOUS INJURY.

A CAUTION gives information about a possible hazard that MAY CAUSE INJURY or PROPERTY DAMAGE.

A NOTE gives important information about a task or the equipment.

A REFERENCE directs the user to additional information about a task or the equipment.

Examples of Multi-Hazard Notices



Recommended Standard Designations

The new designation of the Electronic Industries Association (EIA) supersedes Recommended Standard (RS) designations. References to the old RS designations may be shown when depicting actual text (e.g., RS-232) as displayed on the unit's Web Server Interface pages or frontpanel menus. All other references in the manual will be shown with the EIA designations.

The user should carefully review the following information:

Safety and Compliance

Electrical Safety and Compliance

The unit complies with the **EN 60950 Safety of Information Technology Equipment (Including Electrical Business Machines)** safety standard.

IF THE UNIT IS OPERATED IN A VEHICLE OR MOVABLE INSTALLATION, MAKE SURE THE UNIT IS STABLE. OTHERWISE, EN 60950 SAFETY IS NOT GUARANTEED.

Electrical Installation

CONNECT THE UNIT TO A POWER SYSTEM THAT HAS SEPARATE GROUND, LINE AND NEUTRAL CONDUCTORS. DO NOT CONNECT THE UNIT WITHOUT A DIRECT CONNECTION TO GROUND.

Sect 3.3 CDM-840 Ground and Power Connections

Operating Environment

DO NOT OPERATE THE UNIT IN ANY OF THESE EXTREME OPERATING CONDITIONS:

- ***AMBIENT TEMPERATURES LESS THAN 0° C (32° F) OR MORE THAN 50° C (122° F).***
- ***PRECIPITATION, CONDENSATION, OR HUMID ATMOSPHERES OF MORE THAN 95% RELATIVE HUMIDITY.***
- ***UNPRESSURIZED ALTITUDES OF MORE THAN 2000 METRES (6561.7 FEET).***
- ***EXCESSIVE DUST.***
- ***FLAMMABLE GASES.***
- ***CORROSIVE OR EXPLOSIVE ATMOSPHERES.***

European Union Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive (1999/5/EC) and EN 301 489-1

Independent testing verifies that the unit complies with the European Union R&TTE Directive, its reference to EN 301 489-1 (***E****lectromagnetic compatibility and* ***R****adio spectrum* ***M****atters [ERM];* ***E****lectro****m****agnetic* ***C****ompatibility [EMC] standard for radio equipment and services, Part 1: Common technical requirements)*, and the Declarations of Conformity for the applicable directives, standards, and practices that follow:

European Union Electromagnetic Compatibility (EMC) Directive (2004/108/EC)

- **Emissions: EN 55022 Class B** – Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.
- **Immunity: EN 55024** – Information Technology Equipment: Immunity Characteristics, Limits, and Methods of Measurement.
- **EN 61000-3-2** – Harmonic Currents Emission
- **EN 61000-3-3** – Voltage Fluctuations and Flicker.
- **Federal Communications Commission Federal Code of Regulation FCC Part 15, Subpart B.**

TO ENSURE THAT THE UNIT COMPLIES WITH THESE STANDARDS, OBEY THESE INSTRUCTIONS:

- Use coaxial cable that is of good quality for connections to the L-Band Type 'N' Rx (receive) female connector.
- Use Type 'D' connectors that have back-shells with continuous metallic shielding.

  Type 'D' cabling must have a continuous outer shield (either foil or braid, or both). The shield must be bonded to the back-shell.
- Operate the unit with its cover on at all times.

European Union Low Voltage Directive (LVD) (2006/95/EC)

Symbol	Description
<HAR>	Type of power cord required for use in the European Community.
	CAUTION: **Double-pole/Neutral Fusing** ACHTUNG: **Zweipolige bzw. Neutralleiter-Sicherung**

International Symbols			
Symbol	**Definition**	**Symbol**	**Definition**
~	Alternating Current	⏚	Protective Earth
⏛	Fuse	⏚	Chassis Ground

For additional symbols, refer to Warnings, Cautions and Notes listed earlier in this Preface.

European Union RoHS Directive (2002/95/EC)

This unit satisfies (with exemptions) the requirements specified in the European Union Directive on the Restriction of Hazardous Substances in Electrical and Electronic Equipment (EU RoHS, Directive 2002/95/EC).

European Union Telecommunications Terminal Equipment Directive (91/263/EEC)

In accordance with the European Union Telecommunications Terminal Equipment Directive 91/263/EEC, the unit should not be directly connected to the Public Telecommunications Network.

CE Mark

Comtech EF Data declares that the unit meets the necessary requirements for the CE Mark.

Product Support

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

Comtech EF Data Headquarters

http://www.comtechefdata.com

Comtech EF Data Corp.

2114 West 7th Street

Tempe, Arizona USA 85281

+1.480.333.2200

Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty or a 90 day extended warranty, whichever is longer. Contact Comtech EF Data for the warranty period specific to the product purchased.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product. The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

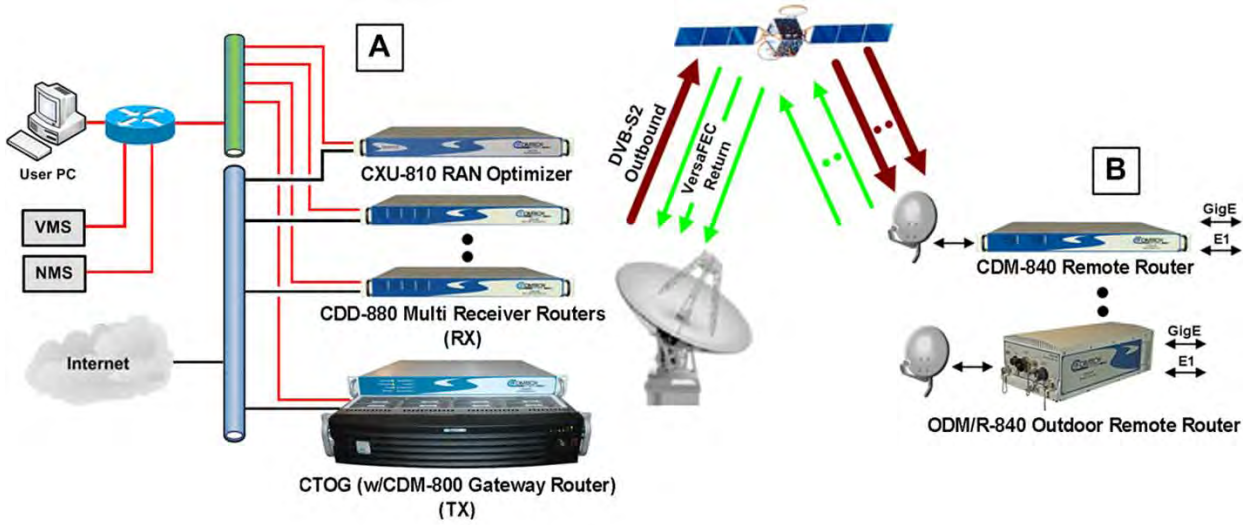
Notes:

Chapter 1. INTRODUCTION

1.1 Overview

Figure 1-1. CDM-840 Remote Router

The CDM-840 Remote Router (**Figure 1-1**) is a point-to-multipoint router. It serves as the "spoke" or remote site equipment component of Comtech EF Data's Advanced VSAT Series group of products.



Feature	Description
A	Hub Site
B	Typical Remote Site Cluster

Figure 1-2. Advanced VSAT Series Network Topology Example

Comtech's Advanced VSAT Series group of products (**Figure 1-2**) are designed to support latency-sensitive applications such as cellular backhaul over satellite, Universal Service Obligation (USO) networks, corporate networks, Internet Service Providers, and other similar hub-and-spoke

network environments that require high-performance, high-quality IP transport with "always-on" availability.

The CDM-840 features one 10/100/1000 Gigabit Ethernet (GigE) interface, one 10/100 Fast Ethernet (FE) interface, and provides WAN bandwidth optimization. It also features integrated VersaFEC, a patented system of short-block codes that provide maximum coding gain with lowest possible latency.

- **Sect. 1.3 CDM-840 Features**
- **Sect. 1.4 CDM-840 Specifications**

1.2 CDM-840 Functional Description

The CDM-840 Remote Router:

- Transmits VersaFEC interoperable with Comtech EF Data's CDD-880 Multi-Receiver Router. The receive side supports DVB-S2 operation at L-Band up to 62 Msps, and is compatible with Comtech EF Data's CTOG-250 Comtech Traffic Optimization Gateway/CDM-800 Gateway Router for Constant Coding and Modulation (CCM) operation.

- Features a high performance processor and a real-time operating system (RTOS) combined with multiple Field Programmable Gate Arrays (FPGAs).

- Runs on an embedded operating system in non-volatile Flash memory. It does not have moving parts for media storage.

- Supports reception and transmission of IP data over satellite links via two fundamentally different types of interface – **IF** and **data**:

    - The **IF** interface provides a bidirectional link with the satellite via the uplink and downlink equipment.

    - The **data** interface is a bidirectional path that connects the customer's equipment (assumed to be the **D**ata **T**erminal **E**quipment, or DTE) to the unit (assumed to be the **D**ata **C**ommunications **E**quipment, or DCE). All terrestrial data is connected using the available 10/100/1000 Gigabit Ethernet interface.

- Includes support for ACM (Adaptive Coding and Modulation) and CCM (Constant Coding and Modulation) operation:

    - CCM allows operators to define groups of remotes having different modulation and coding parameters, as a means to improve efficiency on existing satellite capacity.

- ACM allows the modulator to automatically and seamlessly adjust the transmitted MODCOD as the environmentally conditions change to maintain QEF (Quasi Error Free) operation.

On the Tx (transmit) side: The return modulator transmits IP datagrams and is compatible with Comtech EF Data's CDD-880 Multi-Receiver Router(s) located at a hub site.

In the FEC encoder, the data is differentially encoded, scrambled, and then VersaFEC-encoded. Following the encoder, the data is fed to the transmit digital filters, which perform spectral shaping on the data signals. The resultant I and Q signals are then fed to the BPSK, QPSK, 8-QAM, or 16-QAM modulator. The carrier is generated by a frequency synthesizer, and the I and Q signals directly modulate this carrier to produce an IF output signal.

On the Rx (receive) side: The DVB-S2 demodulator supports enhanced GSE decapsulation and label filtering for up to 2,047 unique labels.

DVB-S2 Receiver: The CDM-840's demodulator supports DVB-S2 QPSK, 8-PSK, 16-APSK and 32-APSK demodulation up to 62 Msps, with receive data rates up to 167 Mbps depending on the modulation type and code rate.

In DVB-S2 operation, the receiver operates in the CCM mode. The receiver automatically detects for spectral inversion and pilots ON/OFF, and supports spectral rolloff of 20%, 25% or 35%.

- **Sect. 1.3 CDM-840 Features**
- **Sect. 1.4 CDM-840 Specifications**
- **Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS**

Monitor and Control Interfaces: The unit is managed through multiple interfaces providing options for both in-band and out-of-band monitor and control:

- **Sect. 6.3 (ETHERNET-BASED PRODUCT MANAGEMENT) SNMP (MIB II and Private MIB)**
- **Sect. 6.4 (ETHERNET-BASED PRODUCT MANAGEMENT) Web Server (HTTP) Interface**
- **Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT**

On-site Firmware Updates: Field update of the operating system firmware is possible through file upload via satellite or the Ethernet port.

Chapter 4. UPDATING FIRMWARE

On-site Operational Upgrades: Field activation of software-based options is possible through Comtech's FAST (**F**ully **A**ccessible **S**ystem **T**opology) Feature upgrade process.

- **Chapter 5. FAST ACTIVATION PROCEDURE**
- **Sect. 6.4.4.2.3 (CDM-840 Web Server Interface) Admin | FAST Page**

1.3 CDM-840 Features

1.3.1 Physical Description

The CDM-840 Remote Router is constructed as a 1RU-high rack-mounting chassis. Handles at the front facilitate removal from and placement into a rack. The unit can be freestanding if desired.

- **Sect. 1.4 CDM-840 Specifications**
- **Sect. 2.1 Installation into a Rack Enclosure**

1.3.2 Dimensional Envelope

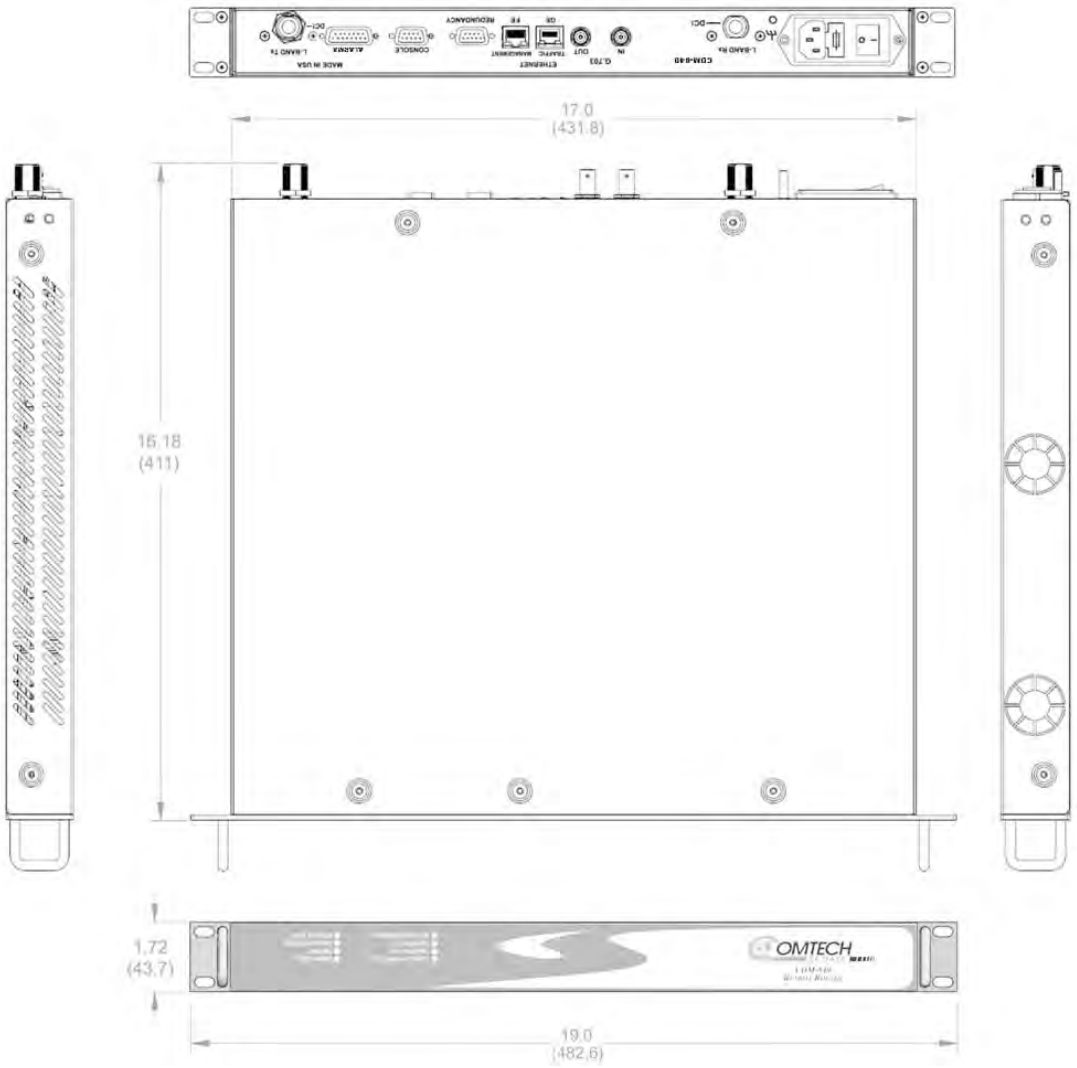


Figure 1-3. CDM-840 Dimensional Envelope

1.3.3 CDM-840 Physical Features

1.3.3.1 Front Panel

Figure 1-4. CDM-840 – Front Panel View

The CDM-840 Remote Router front panel (**Figure 1-4**) features eight Light-Emitting Diode (LED) indicators. These LEDs convey operational states as follows:

LED	Condition	
UNIT STATUS	Green	No Unit Faults or Alarms.
	Amber	No Unit Faults, but an Alarm exists.
	Red	A Unit Fault exists (Example: PSU fault).
STORED EVENT	Amber	There is a Stored Event in the log, which can be viewed from the Web Server Interface
	Off	There are no Stored Events.
ONLINE	Green	The Unit is On Line, and carrying traffic.
	Off	The Unit is Off Line (standby) – forced by externally connected 1:1 or 1:N redundancy system.
TEST MODE	Amber	A Test Mode is selected
	Off	There is no Test Mode currently selected.
TRANSMITTER ON	Green	The Transmitter Carrier is On.
	Red	A Fault exists that causes the unit to turn off the carrier.
	Off	The Transmitter Carrier is Off.
Tx TRAFFIC	Green (solid)	No Tx Traffic Faults, no packets.
	Green (blinking)	No Tx Traffic Faults, blinks when a packet is being transmitted to the satellite link from this unit.
	Amber	A Tx Traffic Alarm exists.
	Red	Tx Traffic has a Fault.
	Off	A Tx Traffic Fault exists.
Rx TRAFFIC	Green (solid)	No Rx Traffic Faults (demod and decoder are locked, everything is OK).
	Green (blinking)	No Rx Traffic Faults, blinks when a packet is being received from the satellite link to this unit.
	Amber	Rx Traffic has an Alarm.
	Red	Rx Traffic has a Fault.
	Off	An Rx Traffic fault exists (the demod may still be OK).
GE LINK/ACTIVITY	Green (solid)	Traffic Ethernet is connected, but no traffic exists.
	Green (blinking)	Ethernet activity detected.
	Off	Traffic Ethernet is not connected.

1.3.3.2 Rear Panel

PROPER GROUNDING PROTECTION IS REQUIRED. The equipment must be connected to the protective earth connection at all times. It is therefore imperative that the unit is properly grounded, using the ground stud provided on the unit rear panel, during installation, configuration, and operation.

- **Sect. 3.2 CDM-840 Cabling Connections**
- **Sect. 3.3 CDM-840 Grounding and Power Connections**

External cables are attached to connectors provided on the rear panel of the unit (**Figure 1-5**).

(Top) Standard AC Unit
(Bottom) Optional 48V DC Unit

Figure 1-5. CDM-840 – Rear Panel View

1.3.3.2.1 Rear Panel Standard Features

The unit provides the following standard interfaces:

Data Interfaces:

- (1X) 10/100/1000 BaseT Gigabit Ethernet RJ-45 Interface (**ETHERNET | TRAFFIC GE** port) for Ethernet traffic.
- (1X) 10/100 BaseT Fast Ethernet RJ-45 Interface for Ethernet-based management and control purposes (HTTP/Web and SNMP) (**ETHERNET | MANAGEMENT FE** port).
- (1X) DB-9F EIA-232 connector for serial remote control (**CONSOLE** port).
- (1X) DB-15M connector for Form C unit alarms, analog Es/No, and Tx Mute (**ALARMS** port).

IF Interfaces:

- (2X) Type 'N' female connectors for 50Ω L-Band (950 to 2150 MHz)

Power Interface:

- 100–240 VAC Primary Input Power Supply with Press-fit Fuse Holder

1.3.3.2.2 Rear Panel Optional Features

The unit provides the following Data Interfaces for optional hardware and/or FAST-enabled operation:

- (2X) Type 'BNC' female connectors labeled "**G.703 | IN** / **OUT**" are provided for operation of the optional G.703 E1 Interface / RAN Optimization FAST Feature upgrade.
- (1X) DB-9M EIA-232 connector labeled "**REDUNDANCY**" for interoperability with a separately purchased Comtech EF Data 1:1 or 1:N Redundancy Switch.

The following Power Interface Options are available from Comtech EF Data:

- 48 VDC Primary Input Power Supply with Screw-in Fuse Holders
- 24 VDC BUC 90 Watt Power Supply (AC Input or DC Input versions)
- 48 VDC BUC 150 Watt Power Supply (AC Input or DC Input versions)

The following Rear Panel Rack Support Brackets Kits are available from Comtech EF Data:

- KT-0000168 4" Rear-Mounting Support Brackets Kit
- KT-0000195 10" Rear-Mounting Support Brackets Kit

Sect. 2.2.1 Installing the Optional Rear-Mounting Support Brackets Kit

1.4 CDM-840 Specifications

1.4.1 Product Feature Specifications

Item		Description
Front Panel		8 Light-Emitting Diodes (LEDs): UNIT STATUS (Green/Amber/Red) — TRANSMITTER ON (Green/Red) STORED EVENT (Amber) — Tx TRAFFIC (Green/Amber/Red) ONLINE (Green) — Rx TRAFFIC (Green/Amber/Red) TEST MODE (Amber) — GE LINK/ACTIVITY (Green)
Data Interfaces		1X RJ-45 female port for 10/100/1000 BaseT Gigabit Ethernet data traffic 1X RJ-45 female port for 10/100 BaseT Fast Ethernet HTTP and SNMP product management 2X Type 'BNC' female connectors for G.703 E1, 2.048 Mbps (Unbalanced 75Ω) DB-9F EIA-232 connector for serial remote monitor and control DB-9M EIA-232 connector for 1:1 or 1:N redundancy switch operation DB-15M connector for Form C unit alarms
Dimensional Envelope		19.0 W x 18.2 D x 1 RU (1.7) H inches (483 W x 462 D x 44 H mm)
Temperature	Operating	32° to 122°F (0° to 50°C)
	Storage	-4° to 158°F (–20° to 70°C)
Humidity		95% maximum, non-condensing
Operating Frequency	Tx	950 – 2150 MHz (L-Band)
	Rx	
Connectors & Impedance	Tx	50 Ω Type 'N' Female Connectors
	Rx	
Power supply	AC	100V to 240V AC, 47-63 Hz
	DC (HW Option)	48V (36V to 60V) DC
Transmit Power		0 to -40 dBm
BUC	Reference (10 MHz)	10.0 MHz ± 0.06 ppm, selectable ON/OFF, 0.0 dBm ± 3 dB
	Power Supply (HW Option)	24VDC, 4.17 Amps max., 90 W @ 50° C; 48VDC, 3.125 Amps max., 150W @ 50° C
LNB	Reference (10 MHz)	10.0 MHz ± 0.06 ppm, Selectable ON/OFF, -3.0 dBm ± 3 dB
	Voltage	Selectable ON/OFF, 13V DC, 18V DC and 24V DC
	Current	500 mA, maximum
Rx Monitoring		Es/No estimate, Receive Signal Level, Frequency Offset, BER, I&Q Constellation (FUTURE)
Adaptive Equalizer		5-tap, selectable, corrects up to 3 dB tilt
Acquisition Range		±100 kHz

Item	Description		
Supported Protocols	RFC 768 – UDP RFC 791 – IP RFC 792 – ICMP RFC 793 – TCP RFC 826 – ARP RFC 856 – Telnet RFC 862 – Ping RFC 894 – IP	RFC 959 – FTP RFC 1112 – IP Multicast RFC 1213 – SNMP MIB II RFC 1812 – IPv4 Routers RFC 2045 – MIME RFC 2474 – DiffServ RFC 2475 – DiffServ RFC 2578 – SMI	RFC 2597 – AF PHB RFC 2598 – Expedite Forwarding RFC 2616 – HTTP RFC 3412 – SNMP RFC 3416 – SNMPv2 RFC 3418 – SNMP MIB

Item	Description	
	Outbound (Hub to Remote)	Return (Remote to Hub)
Data Rate	1 – 168 Mbps	16 kbps – 15.35 Mbps
Symbol Rate	1 – 62 Msps (QPSK, 8-PSK) 1 – 47 Msps (16-APSK, 32-APSK)	16 ksps – 4.5 Msps
FEC	DVB-S2	VersaFEC
Modulation and Code Rates	• QPSK 1/2, 1/3, 1/4, 2/3, 2/5, 3/4, 3/5, 4/5, 5/6, 8/9, 9/10 • 8-PSK 2/3, 3/4, 3/5, 5/6, 8/9, 9/10 • 16-APSK 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 • 32-APSK 3/4, 4/5, 5/6, 8/9, 9/10	• BPSK 0.488 • QPSK 0.533, 0.631, 0.706, 0.803 • 8-QAM 0.642, 0.711, 0.780 • 16-QAM 0.731, 0.780, 0.829, 0.853
Rolloff	20%, 25% and 35%	20%, 25% and 35%
Encapsulation	Enhanced GSE	Streamline Encapsulation (SLE)

1.4.2 Bit Error Rate (BER)

Item	Description				
VersaFEC CODEC BER BPSK (With two adjacent carriers, each 7 dB higher than the desired carrier)	For: BER=10-5 BER=10-8	Rate 0.488 Guaranteed Eb/No (typical value in parentheses): 2.4 dB (2.1 dB) 2.7 dB (2.4 dB)			
VersaFEC CODEC BER QPSK (With two adjacent carriers, each 7 dB higher than the desired carrier)	For: BER=10^{-5} BER=10^{-8}	Rate 0.533 QPSK Guaranteed Eb/No (typical value in parentheses): 2.3 dB (2.0 dB) 2.5 dB (2.2 dB)	Rate 0.631 QPSK Guaranteed Eb/No (typical value in parentheses): 2.8 dB (2.5 dB) 3.0 dB (2.7 dB)	Rate 0.706 QPSK Guaranteed Eb/No (typical value in parentheses): 3.3 dB (3.0 dB) 3.7 dB (3.4 dB)	Rate 0.803 QPSK Guaranteed Eb/No (typical value in parentheses): 3.8 dB (3.5 dB) 4.1 dB (3.8 dB)
VersaFEC CODEC BER 8QAM (With two adjacent carriers, each 7 dB higher than the desired carrier)	For: BER=10^{-5} BER=10^{-8}	Rate 0.642 8QAM Guaranteed Eb/No (typical value in parentheses): 4.6 dB (4.3 dB) 4.9 dB (4.6 dB)	Rate 0.711 8QAM Guaranteed Eb/No (typical value in parentheses): 5.2 dB (4.9 dB) 5.5 dB (5.2 dB)	Rate 0.780 8QAM Guaranteed Eb/No (typical value in parentheses): 5.6 dB (5.3 dB) 6.0 dB (5.7 dB)	

Item	Description				
VersaFEC CODEC BER 16QAM (With two adjacent carriers, each 7 dB higher than the desired carrier)	For: BER=10^{-5} BER=10^{-8}	Rate 0.731 16QAM Guaranteed Eb/No (typical value in parentheses): 6.4 dB (6.1 dB) 6.6 dB (6.3 dB)	Rate 0.780 16QAM Guaranteed Eb/No (typical value in parentheses): 7.0 dB (6.7 dB) 7.3 dB (7.0 dB)	Rate 0.829 16QAM Guaranteed Eb/No (typical value in parentheses): 7.5 dB (7.2 dB) 7.8 dB (7.5 dB)	Rate 0.853 16QAM Guaranteed Eb/No (typical value in parentheses): 8.0 dB (7.7 dB) 8.3 dB (8.0 dB)
Monitor Functions	Eb/No estimate: 3 to 12 dB with ± 0.5 dB accuracy Corrected Bit Error Rate: 1E-3 to 1E-9 Frequency offset: ± 32 kHz range,100 Hz resolution Signal Strength Indicator: 0-60 dB range relative to maximum gain				

1.4.3 Standard Assemblies

CEFD Item No.	Description	Where Installed
PL-0020642	CDM-840 Base AC Chassis Assembly	–
PL-0000714	CDM-840 PCB Assembly	In CDM-840 chassis
FS-0000030	Cartridge Fuse, 2.5A 250VAC 5x20mm Slow Blo fuse, 213 series	In CDM-840 chassis

1.4.4 Optional Assemblies

CEFD Item No.	Description	Where Installed
PL-0000881	CDM-840 100-240V AC unit w/24V DC 90W @ 50°C BUC Power Supply	In CDM-840 chassis
PL-0000883	CDM-840 100-240V AC unit w/48V DC 150W @ 50°C BUC Power Supply	In CDM-840 chassis
PL-0020644	CDM-840 Base 48V DC Chassis Assembly	–
PL-0000974	CDM-840 48V DC unit w/24V DC 90W @ 50°C BUC Power Supply	In CDM-840 chassis
PL-0000975	CDM-840 48V DC unit w/48V DC 150W @ 50°C BUC Power Supply	In CDM-840 chassis
KT-0000168	Rear-Mounting Support Bracket (4”)	Sides of CDM-840 chassis / rear of user-supplied mounting rack
KT-0000195	Rear-Mounting Support Bracket (10”)	

1.4.5 Regulatory Compliance

Entity	Description
“CE” as follows:	• EN 30489-1 • EN 55022 Class B (Emissions) • EN 55024 (Immunity) • EN 60950 (Safety)
FCC	FCC Part 15 Subpart B
RoHS Compliance	Yes

Chapter 2. INSTALLATION

2.1 Unpacking and Inspecting the Shipment

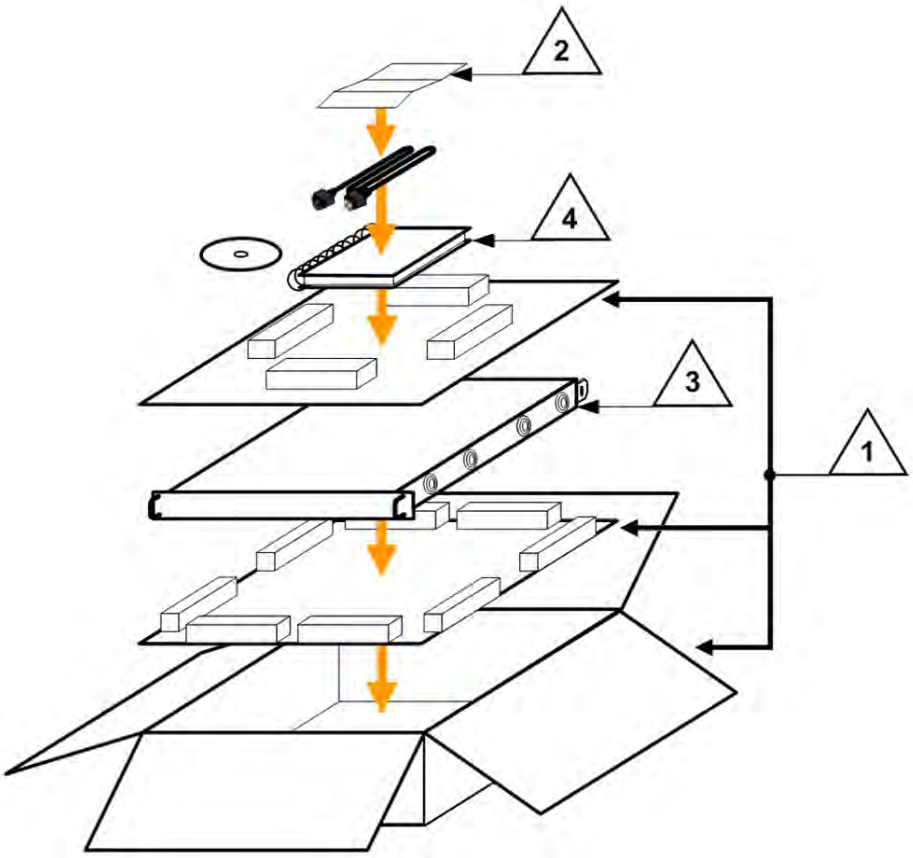


Figure 2-1. Unpacking and Inspecting the Shipment

The CDM-840 Remote Router, its Installation and Operation Manual, and its power cord were packaged and shipped in a reusable cardboard carton containing protective foam spacing.

This equipment contains parts and assemblies sensitive to damage by Electrostatic Discharge (ESD). Use ESD precautionary procedures when handling the equipment.

Once opened, inspect the shipment (Figure 2-1):

Step	Task
1	Keep all shipping materials for storage or reshipment.
2	Check the packing list to ensure the shipment is complete.
3	Inspect the equipment for any possible damage incurred during shipment. Contact the carrier and Comtech EF Data immediately to submit a damage report if damage is evident.
4	***Review this* CDM-840 Remote Router Installation and Operation Manual *carefully to become familiar with operation.***
5	***Proceed to* Sect. 2.2 Installing Into a Rack Enclosure.**

2.2 Installing Into a Rack Enclosure

When mounting the CDM-840 into a rack enclosure (Figure 2-2):

- ***PROPER GROUNDING PROTECTION IS REQUIRED. The equipment must be connected to the protective earth connection at all times. It is therefore imperative that the unit is properly grounded, using the ground stud provided on the unit rear panel, during installation, configuration, and operation.***

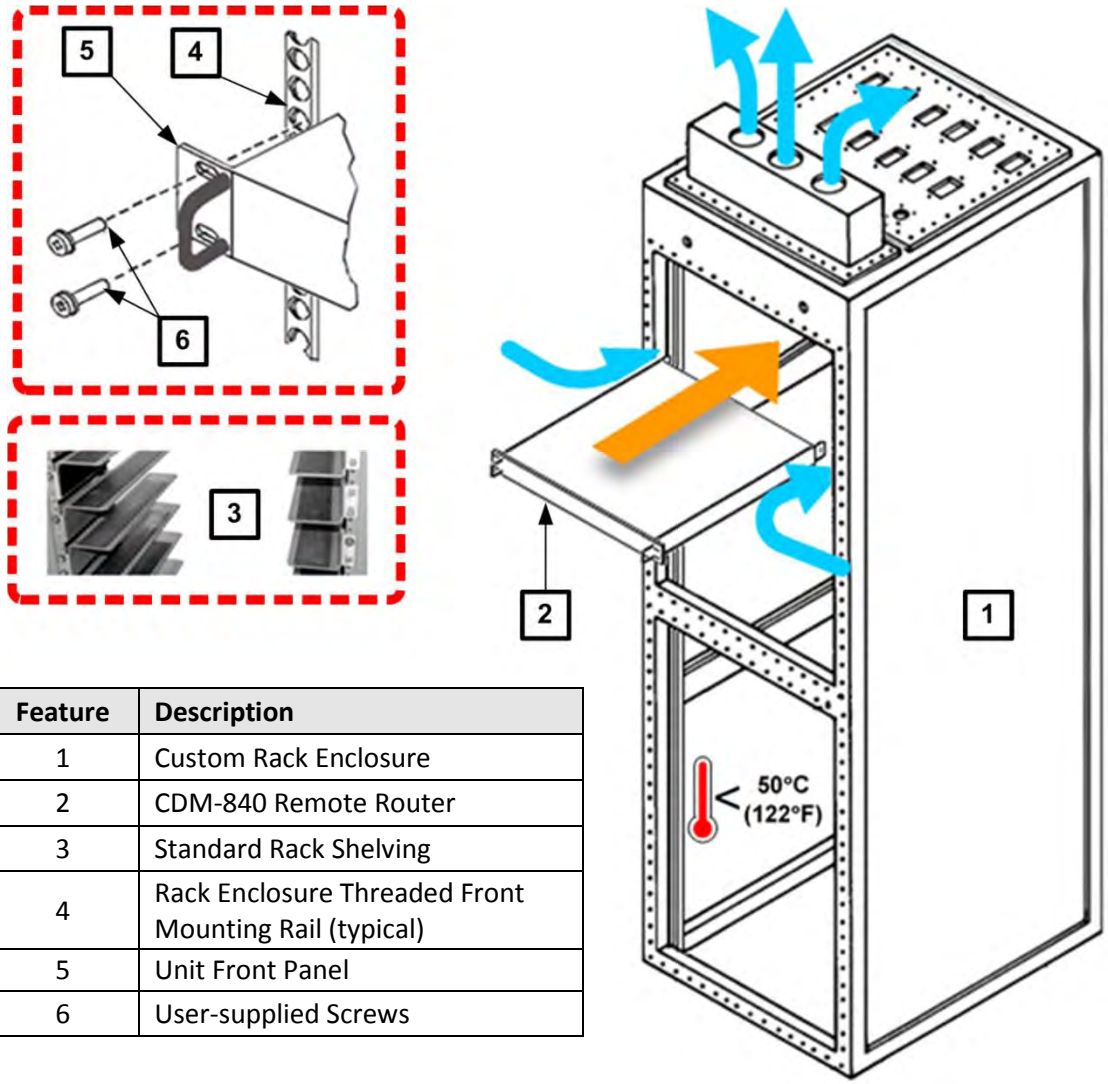
- ***PROPER AIR VENTILATION IS REQUIRED. In a rack system where there is high heat discharge, provide forced-air cooling with top- or bottom-mounted fans or blowers.***

    - ***Make sure there is adequate clearance inside the enclosure, especially at the side for air ventilation.***

    - ***Air temperature inside the rack enclosure should never exceed 50°C (122°F).***

  For information about custom rack enclosures, contact Comtech EF Data Customer Support during normal business hours or visit Comtech EF Data's Web site (www.comtechefdata.com/support.asp).

- ***The CDM-840 CANNOT have rack slides mounted to the sides of the chassis. Cooling fans and exhaust vents are provided here – air flow must not be impeded. Comtech EF Data recommends that an alternate method of support is provided within the rack, such as standard rack shelves or the optional Rear-Mounting Support Bracket Kit. If there is any doubt, contact Comtech EF Data Customer Support during normal business hours.***



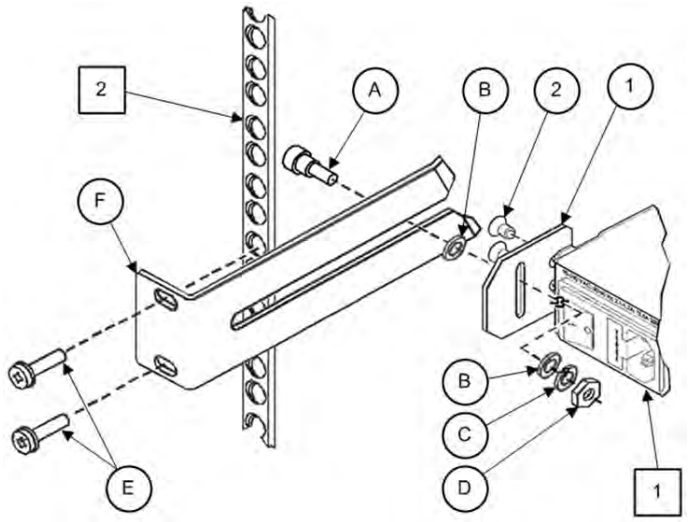
Feature	Description
1	Custom Rack Enclosure
2	CDM-840 Remote Router
3	Standard Rack Shelving
4	Rack Enclosure Threaded Front Mounting Rail (typical)
5	Unit Front Panel
6	User-supplied Screws

Figure 2-2. Installing the CDM-840 into a Rack Enclosure

Mount the CDM-840 in its assigned position in the rack enclosure. Use, as required:

- A standard rack-mounted shelf;
- User-supplied screws to secure the front panel to the rack enclosure threaded front mounting rails;
- Comtech EF Data's optional KT-0000168 (4") or KT-0000195 (10") Rear-Mounting Support Brackets Kit (**Figure 2-3**).

2.2.1 Installing the Optional Rear-Mounting Support Brackets Kit



Feature	Description
1	Back of Unit
2	Rack Enclosure Threaded Rear Mounting Rail (typical)

KT-0000XXX Primary Rear Support Bracket Kit				
Item	Quantity		CEFD Part Number	Description
	KT-0000168	KT-0000195		
1	2	2	FP-0000913	Plate, Adapter
2	4	4	HW/10-32X3/8FLT	Screw, #10 Flat Head
3	1	–	KT/6228-2	4” Rear Support Bracket Kit
	–	1	KT/6228-3	10” Rear Support Bracket Kit

KT/6228-X Rear Support Bracket Kit				
Item	Quantity		CEFD Part Number	Description
	KT/6228-2	KT/6228-3		
A	2	2	HW/10-32SHLDR	Screw, #10 Shoulder
B	4	4	HW/10-32FLT	Washer, #10 Flat
C	2	2	HW/10-32SPLIT	Washer, #10 Split
D	2	2	HW/10-32HEXNUT	Nut, #10 Hex
E	4	4	HW/10-32x1/2RK	Bolt, #10 Rack Bracket
F	2	–	FP/6138-2	Bracket, Rear Support – 4”
	–	2	FP/6138-3	Bracket, Rear Support – 10”

Figure 2-3. Installing the Optional Rear-Mounting Support Brackets Kit

Tools needed to install the KT-0000168 (4”) or KT-0000195 (10”) Bracket Kit (**Figure 2-3**):

- A medium Phillips™ screwdriver
- A 5/32-inch SAE Allen™ Wrench
- An adjustable Crescent™ wrench.

Follow these steps to install the *Radyne-style chassis* kit:

Step	Description
1	Assemble the Adapter Plates to the back side of the CDM-840 chassis using the #10 Flat Head Screws.
2	Assemble the #10 Shoulder Screws through the Adapter Plate mounting slots using the #10 Flat Washers, #10 Split Washers, and #10 Hex Nuts.
3	Mount the Rear Support Brackets to the rack enclosure threaded rear mounting rails using the #10 Rack Bracket Bolts.
4	Slide the CDM-840 into the front of the rack enclosure. Make sure that the #10 Shoulder Screws properly engage into the slots of the Rear Support Brackets.

Notes:

Chapter 3. REAR PANEL CONNECTIONS

3.1 Cabling Connection Types

The CDM-840 Remote Router uses a number of different cables. Each cable type is typically dedicated to a specific mode of operation.

Not all of these operational interface types may be available with this product.

3.1.1 Coaxial Cable Connections

Coupling Type	Connector Type	
	Plug	Jack
Bayonet (Type 'BNC' shown)		
Threaded (Type 'N' shown)		

Figure 3-1. Coaxial Connector Examples

The types of coaxial cables used by Comtech EF Data are '**BNC'**, '**TNC'**, '**N'**, '**F'**, and '**SMA'**. Coaxial cables (plugs) and their mating connectors (jacks/sockets) are available in two coupling styles: **Bayonet** or **Threaded**.

- **Bayonet Coupling Style:** The jack has a pair of guide posts that accommodate the plug's lockdown slots. This lockdown design provides secure assembly without over-tightening the connection.

- **Threaded Coupling Style:** The jack features external threads. The plug shell features internal threads, and has either a knurled outer surface to permit hand-tightening of the connection, or hex flats to accommodate torqued installation.

Connection Instructions:

- **Bayonet Coupling Connections:** Use the plug slots to guide, then slide the plug onto the jack posts. Then, turn the plug clockwise until the jack posts are fully seated within the plug slot.

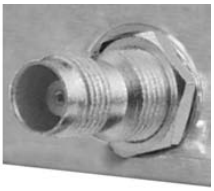
- **Threaded Coupling Connections:** Engage the plug onto the jack threads, and then turn the plug clockwise until it is fully threaded onto the jack. Do not over-tighten the connection.

3.1.1.1 Type 'BNC'

BNC plugs and jacks feature a **Bayonet Coupling** design.

3.1.1.2 Type 'TNC'

TNC plugs and jacks feature a **Threaded Coupling** design similar to Type 'N', Type 'F,' and Type 'SMA' connectors.



3.1.1.3 Type 'N'

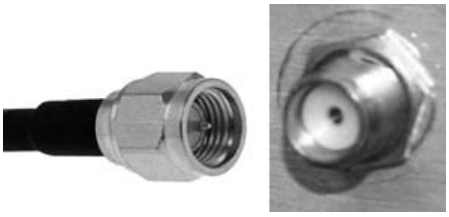
Type 'N' connectors feature a **Threaded Coupling** design similar to Type 'TNC', Type 'F', and Type 'SMA' connectors.

3.1.1.4 Type ‘F’

Type ‘F’ connectors feature a **Threaded Coupling** design similar to Type ‘TNC’, Type ‘N’, and Type ‘SMA’ connectors.

3.1.1.5 Type ‘SMA’ (Subminiature Version ‘A’)

Type ‘SMA’ connectors feature a **Threaded Coupling** design similar to Type ‘TNC’, Type ‘N’, and Type ‘F’ connectors.



3.1.2 D-Subminiature Cable Connections

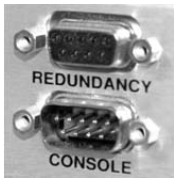
Type ‘D’ Connection Type	Example
Chassis Receptacles: Female (top) Male (bottom)	
Type ‘D’ Cable with Jack Screws (female shown)	

Figure 3-2. D-Subminiature Connector Examples

D-Subminiature connectors are also called **Type ‘D’** or ‘**D-Sub**’ connectors. The connector pair features multiple rows of pins (male side) coupled to mating sockets (female side). The cable plug and chassis receptacle each feature a D-shaped profile that interlock to ensure proper pin orientation and connector seating.

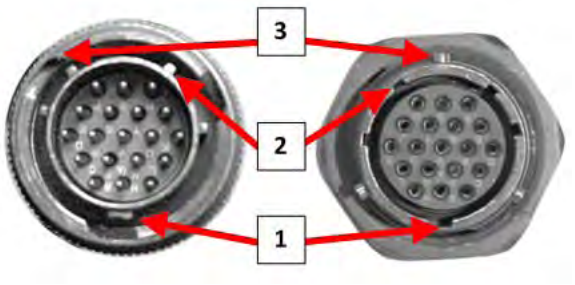
Either chassis receptacle gender features two jack nuts for secure assembly of the cable plug to the chassis receptacle.

Whether its gender is male or female, the cable plug features two jack screws for secure connection to the jack nuts provided on the mating chassis receptacle. The jack screws may be hand tightened or tightened with a standard flat-blade screwdriver.

Connection Instructions: Orient the plug to the receptacle in the proper position. Press firmly into place. Use the jack screws to secure the plug to the receptacle jack nuts. Do not over-tighten.

3.1.3 Circular Cable Connections

Circular connectors are intended for weatherproof outdoor applications. The connector pairs feature a sleeve lock configuration, with an array of pins (male side) coupled to mating sockets (female side).



Feature	Description
1	Primary Alignment features
2	Secondary Alignment features
3	Sleeve Lock features

Connection Instructions: Engage all of the alignment and lock features between the male connector (on the interconnection cable) and female socket (e.g., the ODM/R-840 CONSOLE/REDUNDANCY port or the POWER port).

To install the male connector into the female connector:

1. Engage the primary and secondary alignment tabs on the male connector with the mating cutouts on the female socket.
2. Push the male connector into the female socket.
3. Turn the male connector sleeve clockwise until the sleeve lock cutouts engage fully with the female socket tabs and you hear a “click” sound

3.1.4 RJ-45, RJ-48 Cable Connections

The plug for an RJ-45 or RJ-48 cable features a flexible tab. The RJ-45 or RJ-48 jack features a mating slot. This design configuration assures proper installation and pin orientation.

Connection Instructions: Press down the tab on the cable plug, and then insert the plug into the RJ-4*x* jack. The connection is complete when the tab ‘clicks’ into position inside the jack.

3.2 CDM-840 Cabling Connections

(Top) Standard AC Unit
(Bottom) Optional 48V DC Unit

Figure 3-3. CDM-840 Cabling Connections

The CDM-840 rear panel connectors, shown here in **Figure 3-3** provide all necessary external connections between the unit and other equipment. The table that follows summarizes the connectors provided here, grouped according to service function.

Sect.	Service Type	Connector Name	Connector Type		Connector Function
3.2.1	IF Group	L-BAND Rx	50Ω Type 'N' female		L-Band Input
		L-BAND Tx	50Ω Type 'N' female		L-Band Output
3.2.2	Terrestrial Data Group	G.703	OUT	BNC female	G.703 E1 Input
			IN	BNC female	G.703 E1 Output
		TRAFFIC | GE	RJ-45 female		10/100/1000 BaseT Gigabit Ethernet interface (IEEE 802.3ab)
3.2.3	Utility Group	MANAGEMENT | FE	RJ-45 female		10/100 BaseT Fast Ethernet management/data interface (IEEE 802.3u)
		REDUNDANCY	9-pin Type 'D' female		For connection to an optional 1:1 or 1"N CEFD Redundancy Switch
		CONSOLE	9-pin Type 'D' male		Serial Remote Interface (EIA-232)
		ALARMS	15-pin Type 'D' male		Unit Alarms

The European EMC Directive (EN55022, EN50082-1) requires using properly shielded cables for DATA I/O. These cables must be double-shielded from end-to-end, ensuring a continuous ground shield.

See* Sect. 3.1 Cabling Connections Types *for information about each connector type and its connection instructions.

3.2.1 IF Connector Group

THERE MAY BE DC VOLTAGES PRESENT ON THE TYPE 'N' RX AND TX IF CONNECTORS, UP TO A MAXIMUM OF 48 VOLTS.

3.2.1.1 'L-BAND Rx' IF Connector

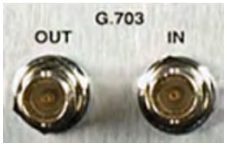
Connector Type	Ref Des	Description	Direction
Type 'N' 50Ω Female	L-BAND Rx	Rx IF Signal, L-Band	In

3.2.1.2 'L-BAND Tx' IF Connector

Connector Type	Name	Description	Direction
Type 'N' 50Ω Female	L-BAND Tx	Tx IF signal, L- Band	Out

3.2.2 Terrestrial Data Connector Group

3.2.2.1 'G.703 | OUT' / 'G.703 | IN' Connectors



Connector Type	Name	Direction
BNC female	G.703 | OUT	Out
	G.703 | IN	In

3.2.2.2 'TRAFFIC | GE' (Gigabit Ethernet) Connector

Connector Type	Name	Direction
RJ-45 female modular jack	TRAFFIC | GE	In/Out

- ***This interface operates at 10/100/1000 Mbps, half and full duplex, auto-negotiating.***
- ***The maximum Ethernet packet size is 1522 bytes (including Ethernet headers and CRC).***

3.2.3 Utility Connector Group

3.2.3.1 'MANAGEMENT | FE' (Fast Ethernet) Connector

Connector Type	Name	Direction
RJ-45 female modular jack	TRAFFIC | GE	In/Out

- ***This interface operates at 10/100 Mbps, half and full duplex, auto-negotiating.***
- ***The maximum Ethernet packet size is 1522 bytes (including Ethernet headers and CRC)***

3.2.3.2 'REDUNDANCY' Connector

Connector Type	Name	Direction
Type 'D' 9-pin female	REDUNDANCY	In/Out

Use this interface for connection to an optional CEFD 1:1 or 1:N Redundancy Switch.

Table 3-1. REDUNDANCY Connector Pinouts

Pin #	Description	Direction
1	Ground	–
6	Transmit Serial Data – auxiliary channel	Out
2	Receive Serial Data – auxiliary channel	In
7	Redundancy Out 1	Out
3	Redundancy In 1	In
8	Redundancy Out 2	Out
4	Redundancy In 2	In
9	Fused +12 volt	Out
5	Ground	–

3.2.3.3 'CONSOLE' Interface Connector

Connector Type	Name	Direction
Type 'D' 9-pin male	CONSOLE	In/Out

This interface is used for EIA-232 communications. It is intended for connection to an M&C computer or VT (Video Terminal) device.

Table 3-2. CONSOLE Connector Pinouts

Pin #	Description	Direction
1	Ground	–
6	Reserved - do not connect to this pin	–
2	EIA-232 Transmit Data	Out
7	Reserved - do not connect to this pin	–
3	EIA-232 Receive Data	In
8	Reserved - do not connect to this pin	–
4	Reserved - do not connect to this pin	–
9	Reserved - do not connect to this pin	–
5		–

3.2.3.4 'ALARMS' Interface Connector

Connector Type	Name	Direction
Type 'D' 15-pin male	ALARMS	In/Out

Pin 2 of this connector provides an analog signal to aid antenna pointing or for driving step-track equipment. The analog signal will be zero volts when the unit is not locked to a carrier. When locked to a carrier the analog signal will be 1 volt for Es/No values less than or equal to -4.69 dB, or 10 volts for Es/No values greater than or equal to 20dB as depicted in the following chart:

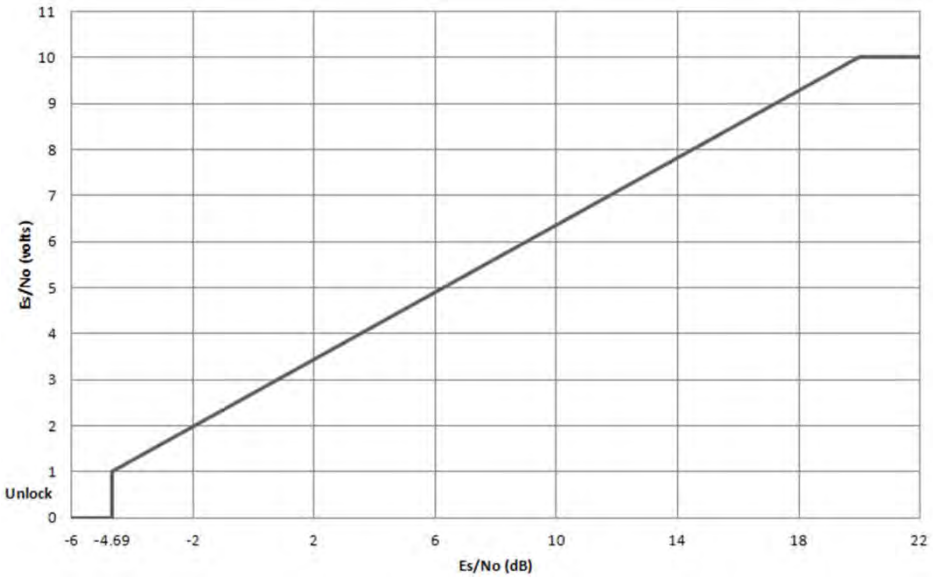


Table 3-3. ALARMS Connector Pinouts

PIN #	SIGNAL FUNCTION	NAME
1	GROUND	GND
9	EXT CARRIER OFF	EXT-OFF
2	ES/NO VOLTAGE (0 TO 10 VOLTS)	ES/NO
10	RESERVED +3.3V INPUT CMOS LEVEL	N/C
3	NO CONNECTION	N/C
11	NO CONNECTION	N/C
4	UNIT FAULT	UNIT-COM
12	UNIT FAULT (ENERGIZED, NO FAULT)	UNIT-NO
5	UNIT FAULT (DE-ENERGIZED, FAULTED)	UNIT-NC
13	TX TRAFFIC	TX-COM
6	TX TRAFFIC (ENERGIZED, NO FAULT)	TX-NO
14	TX TRAFFIC (DE-ENERGIZED, FAULTED)	TX-NC
7	RX TRAFFIC	RX-COM
15	RX TRAFFIC (ENERGIZED, NO FAULT)	RX-NO
8	RX TRAFFIC (DE-ENERGIZED, FAULTED)	RX-NC

3.3 CDM-840 Ground and Power Connections

3.3.1 Chassis Ground Interface

PROPER GROUNDING PROTECTION IS REQUIRED. The equipment must be connected to the protective earth connection at all times. It is therefore imperative that the unit is properly grounded, using the ground stud provided on the unit rear panel, during installation, configuration, and operation.

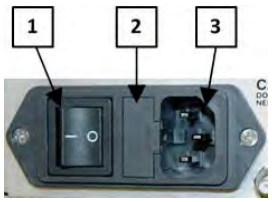
(Top) Standard AC Unit
(Bottom) Optional 48V DC Unit

Figure 3-4. CDM-840 Chassis Ground Interface

Use the #10-32 stud, located adjacent to the power interface, for connecting a common chassis ground among equipment.

The AC power interface provides the safety ground.

3.3.2 115V/230V Alternating Current (AC) Power Interface (Standard)



Feature	Description
1	On / Off Switch
2	Press-fit Fuse Holder
3	IEC Three-prong Connector

AC Power Specifications	
Input Power	40W maximum, 20W typical (without BUC) 245W maximum (with BUC)
Input Voltage	100V to 240V AC, +6%/-10%, autosensing (total absolute max. range is 90V to 254V AC)
Connector Type	IEC
Fuse Protection	**Line and neutral fusing** **(2X) 5mm x 20mm Slow-blow type fuses:** T2.5A (2.5A) (115V or 230V AC operation – without BUC) T4A (4.0A) (115V or 230V AC operation – with BUC)

Figure 3-5. CDM-840 AC Power Interface

3.3.2.1 AC Operation – Applying Power

Figure 3-6. Applying AC Power to the CDM-840

To apply AC power to the CDM-840:

- **First, plug the provided AC power cord female end into the unit.**
- **Then, plug the AC power cord male end into the user-supplied power source.**
- **Finally, switch the unit ON.**

3.3.2.2 AC Operation – Replacing Fuses

The CDM-840 uses two 5mm x 20mm Slow-blow fuses – one each for line and neutral connections. The fuses are contained within a fuse holder that is press-fit into the body of the power supply module located on the rear panel (**Figure 3-7**).

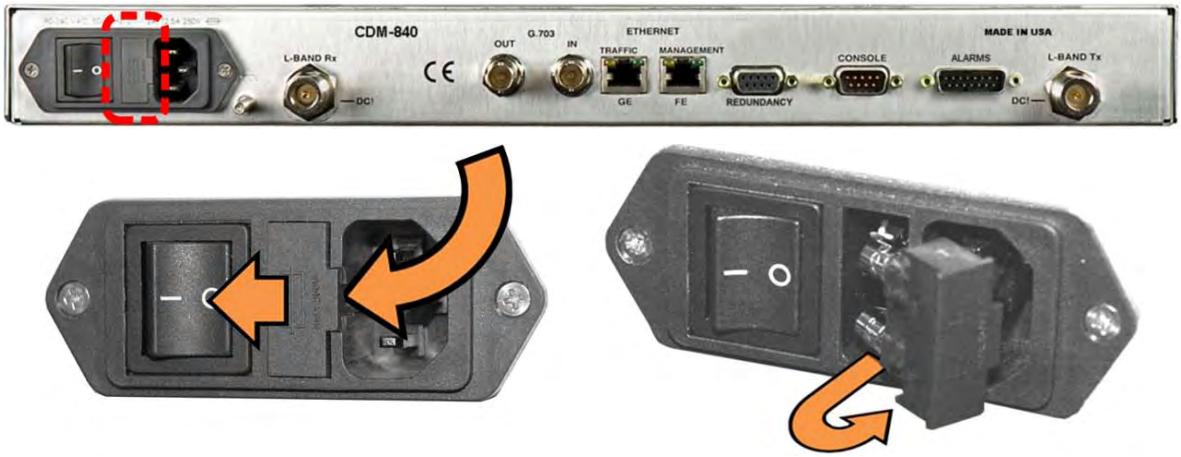


Figure 3-7. Replacing CDM-840 AC Fuses

To replace the fuses:

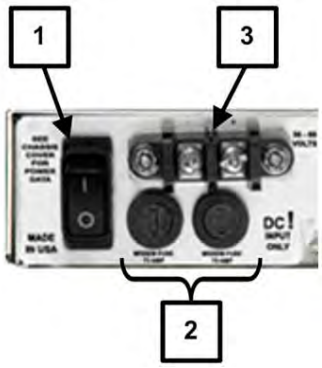
DISCONNECT THE POWER SUPPLY BEFORE PROCEEDING!

- **First, unseat the fuse holder from the IEC power module.**
  - Use the slot to pry the holder outward from the IEC power module.
  - Pull the holder straight out, and then swing the holder away from the module.
- **Then, remove and replace the fuses as needed.**
  - Use **T2.5A (2.5 Amp)** fuses for standard operation.
  - Use **T4A (4 Amp)** fuses when a Block Upconverter (BUC) is installed.

FOR CONTINUED OPERATOR SAFETY, ALWAYS REPLACE THE FUSES WITH THE CORRECT TYPE AND RATING.

- **Finally, re-seat the fuse holder in the IEC power module.**

3.3.3 48V Direct Current (DC) Power Interface (Optional)



Feature	Description
1	On / Off Switch
2	Screw-in Fuse Holders / Receptacles
3	Power Terminal Block

DC Power Specifications	
Input Power	25W (typical) 245W (maximum with BUC)
Input Voltage	48V DC, nominal (36V to 60V)
Connector Type	Terminal Block
Fuse Protection	(2X) 5mm x 20mm Slow-blow type fuses: T3A (3.0A) Main T5A (5.0A) (BUC)

Figure 3-8. CDM-840 DC Power Interface

3.3.3.1 DC Operation – Applying Power

Figure 3-9. Applying DC Power to the CDM-840

To apply DC power to the CDM-840:

- First, connect the user-supplied (+) and (–) DC power leads to their respective terminals. *Number 18 AWG minimum wires are recommended.*
- Then, connect the user-supplied DC power leads to the power source.
- Finally, switch the unit ON.

3.3.3.2 DC Operation – Replacing Fuses

The fuses are contained within individual screw-in receptacles located below the power supply terminal block (**Figure 3-10**).

Figure 3-10. Replacing CDM-840 DC Fuses

To replace the fuses:

DISCONNECT THE POWER SUPPLY BEFORE PROCEEDING!

- **First, unscrew either fuse holder from its receptacle. Then, remove and replace the fuse(s):**
  - Use **T3A (3 Amp)** fuses for standard operation
  - Use **T5A (5 Amp)** fuses when a Block Upconverter (BUC) is installed.

FOR CONTINUED OPERATOR SAFETY, ALWAYS REPLACE THE FUSES WITH THE CORRECT TYPE AND RATING.

- **Screw either fuse holder back into its receptacle.**

Chapter 4. UPDATING FIRMWARE

4.1 Updating Firmware via the Internet

TO ENSURE OPTIMAL PERFORMANCE, IT IS IMPORTANT TO OPERATE THE CDM-840 WITH ITS LATEST AVAILABLE FIRMWARE.

The CDM-840 Remote Router is factory-shipped with the latest version of operating firmware. Firmware updates may be applied to an in-service CDM-840 without having to remove the chassis cover. If a firmware update is needed, it can be acquired:

- Over satellite;
- From Comtech EF Data Product Support via e-mail or on CD by standard mail delivery.

Use the CDM-840 to accomplish the firmware update process as follows:

- Establish the proper communications link for acquiring the firmware update archive files over satellite or by connecting the rear panel '**Management | FE'** 10/100 Fast Ethernet port to the Ethernet port of a user-supplied PC.
- Download the firmware update archive file from the Internet to the user PC.
- Transfer the extracted firmware update via File Transfer Protocol (FTP) from the user PC to the CDM-840 by directing the FTP client (using the CDM-840 Management IP Address) to connect to an FTP server.

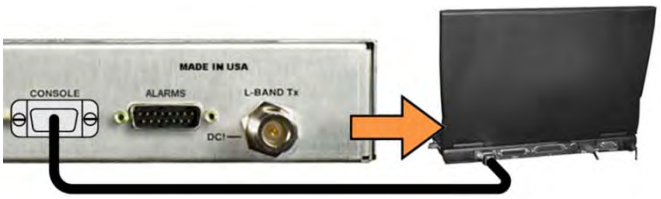
4.2 Getting Started: Preparing for the Firmware Download

1. **First, identify the CDM-840 assigned Management IP Address, and the firmware number/revision letter/version number.**

   User-supplied items needed:

   - A Microsoft Windows-based PC, equipped with available serial and Ethernet ports; a compatible Web browser (e.g., Internet Explorer); and a terminal emulator program (e.g., Tera Term or HyperTerminal).
   - A 9-pin serial cable to connect the PC to the CDM-840.

   A. Use the 9-pin serial cable to connect the CDM-840 'CONSOLE' port to a serial port on the user PC.



   B. On the PC: Open the terminal emulator program.

   Refer to your terminal emulator program HELP feature or user guide for operating and configuration instructions.

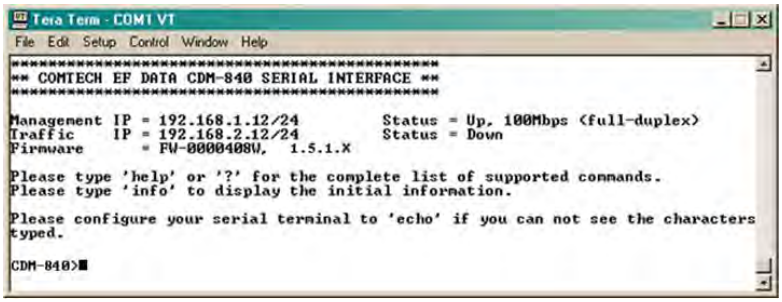
   Configure the utility program serial port communication and terminal display operation:

   - **38400 bps (Baud Rate)**
   - **8 Data Bits**
   - **1 Stop Bit**
   - **Parity = NO**
   - **Port Flow Control = NONE**
   - **Display New line Rx/Tx: CR**
   - **Local Echo = ON**

   C. On the CDM-840: Turn on the power.

(Left) Standard CDM-840 115V/230V AC Unit
(Right) Optional CDM-840 48V DC Unit

   D. On the PC: Make note of the information displayed on the CDM-840 Serial Interface:



- **Management IP Address (e.g., default is 192.168.1.12/24)**
- **Firmware Number and Revision Letter (e.g., FW-0000408W)**
- **Firmware Release Version (e.g., 1.5.1.X)**

See* Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT *for information and instructions on using the CDM-840 Serial Interface.

E. Alternately, use the CDM-840 Web Server Interface to obtain the firmware information.

- **Use an Ethernet hub, switch, or direct cable connection to connect the CDM-840 'MANAGEMENT | FE' 10/100 Fast Ethernet port to the PC.**

- **On the PC: Use a Web browser (e.g., Internet Explorer) to log in to the CDM-840 Web Server Interface and access the 'Admin | Firmware' page. Then, make note of the Slot #1 and Slot #2 firmware loads:**

Slot Information

Slot #	Running	Name	Version	Date	Size
1	No	FW-0000408T	1.4.5		
2	Yes	FW-0000408W	1.5.1.X		

See* Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT *for information and instructions on using the CDM-840 Web Server Interface.

2. Next, create a temporary folder (subdirectory) on the user PC for the firmware archive download.

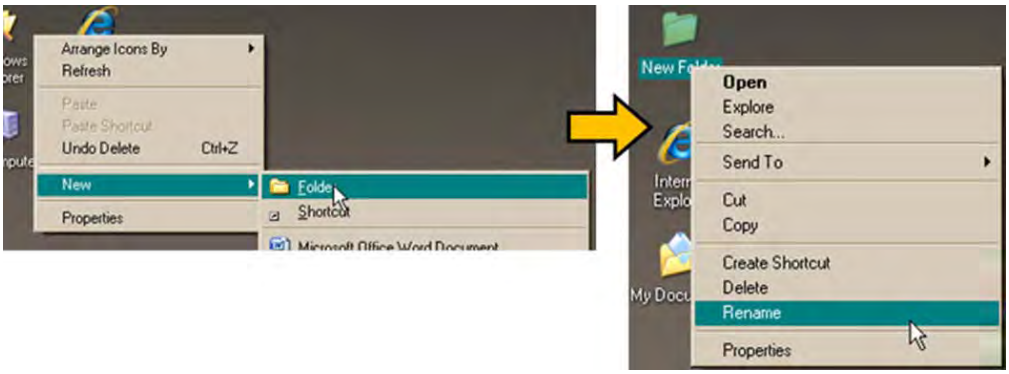
- ***Drive letter "c:" is used in these examples. Any valid, writable drive letter can be used.***
- ***Typical for all tasks: Type the command* <u>without quotes</u>*, and then press* Enter *to execute.***

There are several ways to create a temporary folder on a Windows-based PC:

A. Use the Windows Desktop to create and rename the temporary folder.

- Right-click anywhere on the desktop to open the popup submenu, and then select **New > Folder** to create the temporary folder. The new folder will be created on the desktop.

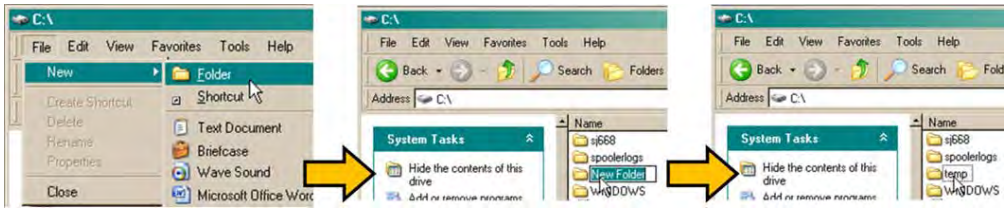
- Right-click on the new folder and then select “**Rename**” from the popup submenu. Rename this folder to "**temp**" or some other convenient, unused name.



B. Use Windows Explorer to create and rename the temporary folder.

- Select **File > New > Folder** to create the temporary folder. The new folder will be created in the active folder.

- Right-click the “**New Folder**” folder name, and then rename this folder to "**temp**" or some other convenient, unused name.



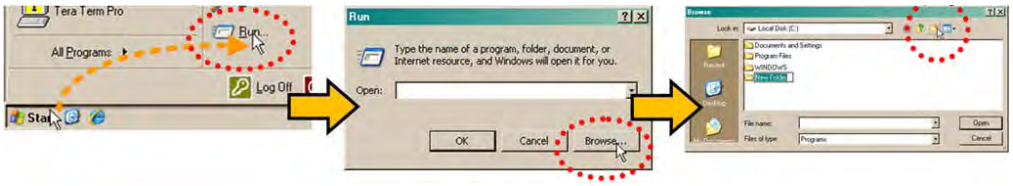
C. Use the ‘Run’ and ‘Browse’ windows to create and rename the temporary folder.

- Select **[Start]** on the Windows taskbar, and then click the **Run...** icon. The ‘**Run’** window will open.

- Click **[Browse]** in the ‘**Run’** window. The ’**Browse’** window will open.

- Click the **Create New Folder** icon in the ‘**Browse’** window. The new folder will be created.

- Right-click the “**New Folder**” folder name, and then rename this folder to “**temp**” or some other convenient, unused name.



D. Use Windows Command-line to create the temporary folder.

- **First,** click **[Start]** on the Windows taskbar, and then click the **Run...** icon (or, depending on Windows OS versions *prior* to Windows 95, click the **MS-DOS Prompt** icon from the Main Menu).

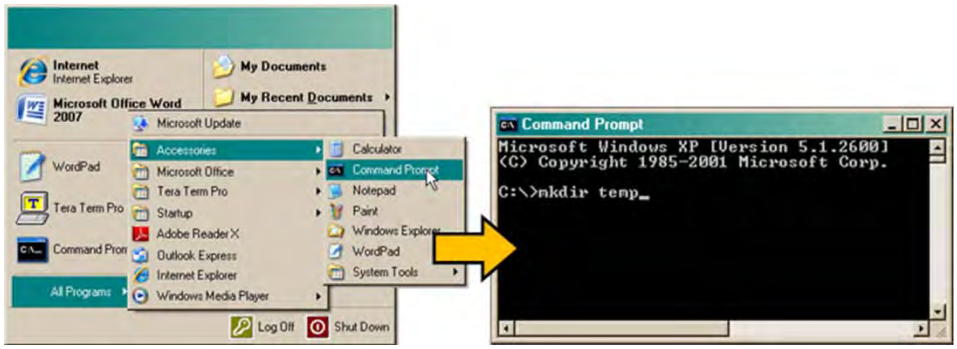
- **Next,** open a **Command-line** window…

  - For Windows 95 or Windows 98, type "**command**".

  - For any Windows OS versions later than Windows 98, type "**cmd**" or "**command**".

  - Alternately, from **[Start]**, select **All Programs > Accessories > Command Prompt**.

  - Finally, from the **Command-line** prompt (**c:\>**), type "**mkdir temp**" or "**md temp**" (*mkdir* and *md* stand for *make directory*), and then click **[OK]**.



There should now be a "temp" folder created and available for placement of the firmware file download.

4.3 Downloading and Extracting the Firmware Update

1. First, download the firmware update file from the Comtech EF Data Web site:

A. **Go online** to www.comtechefdata.com.

B. **On the *Main* page** – under **Support Information** or the **Support** tab, select the **Software Downloads** hyperlink.

C. **On the *Software Downloads* page** – click **Download Flash and Software Update Files**.

D. **On the *Flash & Software Update Files* page** – select the **(Select a Product Line) Advanced VSAT Series** hyperlink.

E. **On the *Advanced VSAT Solutions* product page** – select the **CDM-840** product hyperlink;

F. Select the appropriate firmware archive EXE or ZIP file download hyperlink.

- **About Firmware Numbers, File Versions, and Formats:** The Comtech EF Data Web site catalogues its firmware update files by product type (e.g., router, modem, etc.), the specific model, and optional hardware configurations.

  The CDM-840 firmware download hyperlink appears as **F0000408X_V####**, where '**X**' denotes the revision letter, and '**####**' represents the firmware version (e.g., V1512 = Version 1.5.1.2).

- **About File Archive Formats:** Comtech EF Data provides its downloadable files in two compressed archive formats: ***.exe** (self-extracting) and ***.zip** (compressed).

  The ***.exe** file does not require a file archiver and compression utility program such as *PKZIP for Windows, WinZip, ZipCentral,* etc. (*PKZIP for DOS* is not supported due to file naming conventions). **Comtech EF Data does not provide this utility program.**

  Some firewalls do not allow the download of ***.exe** files. Download the ***.zip** file instead, and extract the firmware files from the archive download with a user-supplied utility program. For detailed information on handling archived files, refer to the utility program Help documentation.

G. Download the archive file to the temporary folder.

- Once the **EXE** or **ZIP** hyperlink is selected, the '**File Download'** window opens and prompts selection of **[Open]** or **[Save]**:

- Click **[Open]** to turn over file extraction to the user-supplied utility program. Be sure to extract the firmware files to the "**temp**" folder created earlier.

- Click **[Save]** to open the '**Save As'** window. Be sure to select and **[Save]** the archive ***.exe** or ***.zip** file to the "**temp**" folder created earlier.

- Otherwise, click **[Cancel]** to quit and exit the file download process.

2. Next, extract the firmware files from the archive file.

- (If not already done with **File Download > [Open]**) Extract the firmware files from the downloaded ***.exe** or ***.zip** archive file with the user-supplied utility program:

  - Double-click on the archive file name, and then follow the prompts provided by the user-supplied utility program. Extract, at a minimum, two files:

    - **FW0000408x_CDM840.bin** – the Firmware Bulk image file (where 'x' denotes the revision letter), and

    - **CDM-840ReleaseNotes_v#-#-#.pdf** – the Firmware Release Notes PDF file (where '#-#-#' denotes the firmware version number).

3. Confirm availability of the firmware files in the temporary folder.

There are several ways you may view the contents of the temporary folder on a Windows-based PC:

A. From the Windows Desktop:

- Double-left-click the "**temp"** folder saved to the Windows Desktop.

- Use **Windows Explorer** to locate, and then double-left-click the "**temp**" folder.

- Use the **Browse** window **([Start] > ...Run > [Browse])** to locate, and then double-click the "**c:\temp**" folder.

B. Using Command-line:

- Type "**cd c:\temp**" at the **Command-line** prompt to change to the temporary directory created earlier using **Command-line**.

- Type "**dir**" to list the files extracted to the temporary directory from the downloaded archive file.

The firmware files have been successfully downloaded and are now available for transfer to the CDM-840.

4.4 Performing the Ethernet FTP Upload Procedure

To proceed with the firmware update procedure, assumptions are made that:

- ***The CDM-840 is connected to a user-supplied, Windows-based PC, and:***
  - ***The PC serial port is connected to the CDM-840 'CONSOLE' port.***
  - ***The PC Ethernet port is connected to the CDM-840 'MANAGEMENT \| FE' 10/100 BaseT Ethernet port with a user-supplied hub, switch, or direct Ethernet cable connection.***
  - ***The PC is running a terminal emulation program (for operation of the CDM-840 Serial Interface) and a compatible Web browser (for operation of the CDM-840 Web Server Interface).***
- ***The CDM-840 Management IP Address has been noted using the CDM-840 Serial Interface, and the firmware has been identified using either the Serial Interface or the CDM-840 Web Server Interface 'Admin \| Firmware' page.***
- ***The latest firmware files have been downloaded or otherwise received from Comtech EF Data and are available on the user PC in an accessible temporary folder.***

1. **Use Command-line to send a "PING" command to confirm proper connection and communication between the user PC and the CDM-840:**

   - **If the Management IP Address of the unit is still not known**, type "**info**" at the Serial Interface **CDM-840>** command prompt and record the displayed information. Alternately, use Serial Remote Control or the Web Server Interface:
     - **Serial Remote Control** – Type the "**<0/IPA?"** remote query (without quotes) at the Serial Interface **CDM-840>** command prompt. The unit returns the configured Management IP Address:

       >0000/IPA=192.168.1.12/24 *(default)*

     - **Web Server Interface** – View the *IP Address/CIDR Mask* entry on the '**Configuration \| Interface \| FE Mgt**' page:

- **Once the Management IP Address is known – use Command-line to PING:** Type "**ping xxx.xxx.xxx.xxx**" at the **Command-line** prompt (where 'xxx.xxx.xxx.xxx' denotes the unit Management IP Address).

  The response should confirm whether or not the unit is properly connected and communicating.

2. **Use Command-line to transfer (FTP) the files from the user PC to the CDM-840:**

   - Type "**ftp xxx.xxx.xxx.xxx**" (where '**xxx.xxx.xxx.xxx**' denotes the unit Management IP Address).

   - Enter the username and password assigned to the unit. The default username and password is "**comtech**".

   - Type "**bin**" to set the binary transfer mode.

   - Type "**put FW-0000408x_CDM840.bin**" (where '**x**' denotes the revision letter) at the **Command-line** prompt, without quotes, to begin the file transfer. The process sequences through several blocks – this may take several minutes for the transfer to occur. Once the upgrade file is transferred, the image is written to Flash memory and the unit transmits the message "**UPLOAD COMPLETE.**"

     In the event you receive the "Connection closed by remote host." message, wait another minute before continuing. The CDM-840 update sometimes takes longer than the FTP client allows.

   - Type "**bye**" to terminate the FTP session, and then close the **Command-line** window.

3. **Use the Serial Interface or the CDM-840 Web Server Interface 'Admin | Firmware' page to verify that the PC-to-Unit FTP file transfer was successful.**

4. **Use the CDM-840 Web Server Interface to select the firmware and reboot the unit:**

   A. **Select the desired Boot Slot (Image):**

   - Go to the CDM-840 Web Server Interface '**Admin | Firmware**' page.

   - Use the '**Boot From:'** drop-down menu to select **Latest**, **Slot 1**, or **Slot 2** (in the ***Firmware Configuration*** section).

     By default, the unit will boot from the Slot that stores the firmware version having the *latest date* (**Boot From: Latest**). '**Boot From:**' may also be set to force the unit to boot up using either firmware image loaded in **Slot #1** or **Slot #2**.

   - Click **[Submit]** to save the setting.

B. Reboot the CDM-840:

- Go to either the CDM-840 Web Server Interface '**Admin | Firmware**' page or the '**Utility | Reboot**' page.

- Click **[Reboot]** (in the ***System Reboot*** section) and **[OK]** when prompted, and then wait while the CDM-840 reboots.

The CDM-840 is now operating with its latest firmware. The firmware update process is now complete.

Chapter 5. FAST ACTIVATION PROCEDURE

5.1 Introduction

The CDM-840 Remote Router incorporates a number of optional features. In order to permit a lower initial cost, you may purchase the unit with only the desired features enabled.

If you wish to upgrade the functionality of a unit at a later date, Comtech EF Data provides **F**ully **A**ccessible **S**ystem **T**opology (**FAST**), which permits the purchase and activation of options through special authorization codes. You may contact Comtech EF Data Product Support to purchase these unique, register-specific **Fast Access Codes**, and then load these codes into the unit using the Web Server Interface (accessible by connecting your PC Ethernet port to the CDM-840 rear panel **'ETHERNET | MANAGEMENT | FE'** port).

FAST System Theory: FAST facilitates on-site upgrade of the operating feature set without removing a unit from the setup. **FAST** technology allows you to order a unit precisely tailored for the initial application. When your service requirements change, you can upgrade the topology of the unit to meet these requirements within minutes. This accelerated upgrade is possible because of **FAST**'s extensive use of the programmable logic devices incorporated into Comtech EF Data products.

FAST Implementation: Comtech EF Data implements the **FAST** system in the modem at the foactory. All **FAST** options are available through the basic platform unit at the time of order – **FAST** allows immediate activation of available options, after confirmation by Comtech EF Data, through the Web Server (HTTP) Interface.

FAST Accessible Options: You may order hardware options for installation either at the factory, or you can install and activate them on-site. The FAST Access Code that you purchase from Comtech EF Data enables configuration of the availavble hardware.

5.2 FAST Activation via the Web Server Interface

See* Sect. 6.4.4.2.3 Admin | FAST *for the complete information on activating FAST Features via the CDM-840 Web Server Interface.

Use the Web Server Interface '**Admin | FAST**' page to manage CDM-840 FAST Features. This page provides scrollable list boxes that display the availability and activation status for all FAST options. FAST code entry/option activation control is also provided.

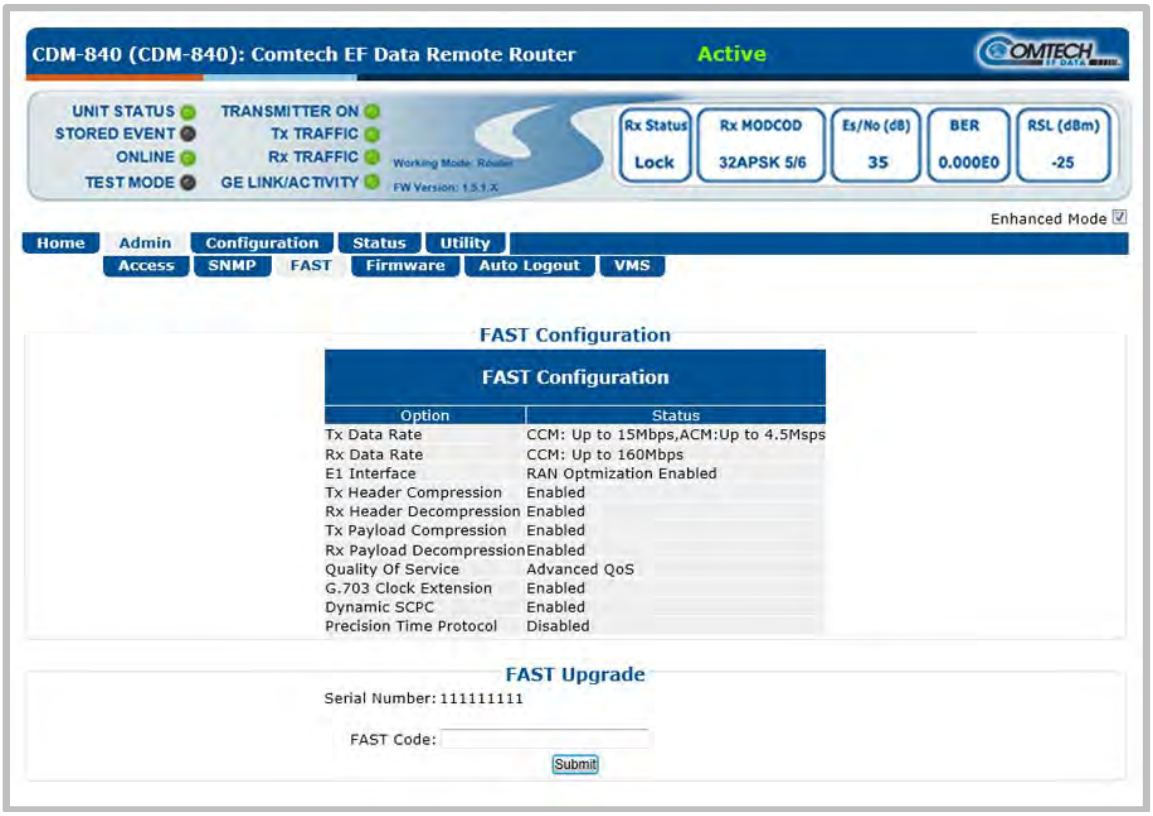


Figure 5-1. CDM-840 Web Server (HTTP) Interface – 'ADMIN | FAST' page

5.2.1 FAST Configuration

The ***read-only*** table in this section displays the CDM-840 available FAST Features and the operational status for each option:

Column	Description
Option	This column lists each available FAST Feature.
Status	This column identifies each FAST Feature operational parameter(s). If an option is not enabled, the column displays this information.

The complete roster of FAST Accessible Options is as follows:

Option	
CCM (VersaFEC only)	16 kbps – 256 kbps Tx Data/Symbol Rate
	16 kbps – 512 kbps Tx Data/Symbol Rate
	16 kbps – 1024 kbps Tx Data/Symbol Rate
	16 kbps – 2.048 Mbps Tx Data/Symbol Rate
	16 kbps – 5 Mbps Tx Data/Symbol Rate
	16 kbps – 10 Mbps Tx Data/Symbol Rate
	16 kbps – 15.35 Mbps Tx Data/Symbol Rate
CCM (DVB-S2 only)	1 – 15 Mbps Rx Data/Symbol Rate
	1 – 45 Mbps Rx Data/Symbol Rate
	1 – 100 Mbps Rx Data/Symbol Rate
E1 Interface	Full Support E1 (hardware upgrade also required)
G.703 Clock Extension	
dSCPC (Dynamic Single Carrier per Channel)	
Precision Time Protocol (PTP) – NOT AVAILABLE IN THIS FIRMWARE RELEASE	

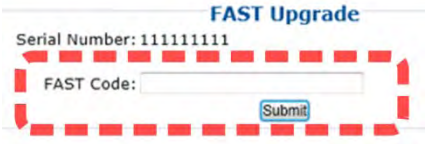
1. ***Tx Header and Payload Compression and Quality of Service (QoS)/Advanced QoS are standard (non-FAST) operational features for Comtech EF Data's Advanced VSAT Series group of products. If these features are listed in the FAST Configuration table, they are always indicated as Enabled.***

2. ***PTP is not available in this firmware release. Once operable, this protocol will be used to synchronize clocks throughout a computer network. When the hardware required for this option is not installed in the CDM-840, the Web page displays the message "PTP not supported with installed hardware".***

3. ***E1 Interface operation is not available with the CDM-840 Reduced Form Factor Outdoor Remote Router***

5.2.2 FAST Upgrade

To perform the CDM-840 FAST option upgrade, follow these steps:

Step	Task
1	Use the **FAST Configuration** table to view the currently installed features. Any options that appear as **Disabled** in the table's *Status* column may be purchased as a FAST upgrade.
2	The serial number of the CDM-800 is required by Comtech EF Data when ordering FAST option upgrades.  Take note of this number, provided here in the **FAST Upgrade** section, before contacting Comtech EF Data: Serial Number: _____
3	Contact Comtech EF Data Product Support: • Provide the CDM-840 Serial Number to the representative. • Identify and purchase the desired FAST option(s). • Obtain the invoice, the 20-digit FAST Access Code, and the FAST option activation instructions.
4	Carefully enter the FAST Access Code into the **FAST Code** register text box. 
5	Click **[Submit]** to execute the FAST Upgrade.
6	The unit either accepts or rejects the code, and the **FAST Configuration** table refreshes to reflect any upgrades in operation.

Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

6.1 Introduction

Ethernet-based Remote Product Management is available through the CDM-840 rear panel '**MANAGEMENT | FE**' RJ-45 10/100 BaseT Fast Ethernet M&C port.

1. ***TO PROCEED WITH ETHERNET-BASED REMOTE PRODUCT MANAGEMENT (SNMP OR WEB SERVER), ASSUMPTIONS ARE MADE THAT:***

   - ***The CDM-840 is operating with the latest version firmware files.***
   - ***The CDM-840 is connected to a user-supplied, Windows-based PC, and:***
     - ***The PC serial port is connected to the CDM-840 'CONSOLE' port with a user-supplied 9-pin serial cable.***
     - ***The PC Ethernet port is connected to the CDM-840 rear panel 'MANAGEMENT | FE' 10/100 BaseT Ethernet port with a user-supplied hub, switch, or direct Ethernet cable connection.***
     - ***The user PC is running a terminal emulation program (for operation of the CDM-840 Serial Interface) and a compatible Web browser (for operation of the CDM-840 Web Server Interface).***
   - ***The CDM-840 Management IP Address has been noted using the CDM-840 Serial Interface.***

2. ***USE OF THE ETHERNET-BASED SNMP INTERFACE IS RECOMMENDED ONLY FOR ADVANCED USERS. ALL OTHER USERS ARE STRONGLY ENCOURAGED TO USE THE CDM-840 WEB SERVER INTERFACE FOR MONITOR AND CONTROL (M&C) OF THE CDM-840.***

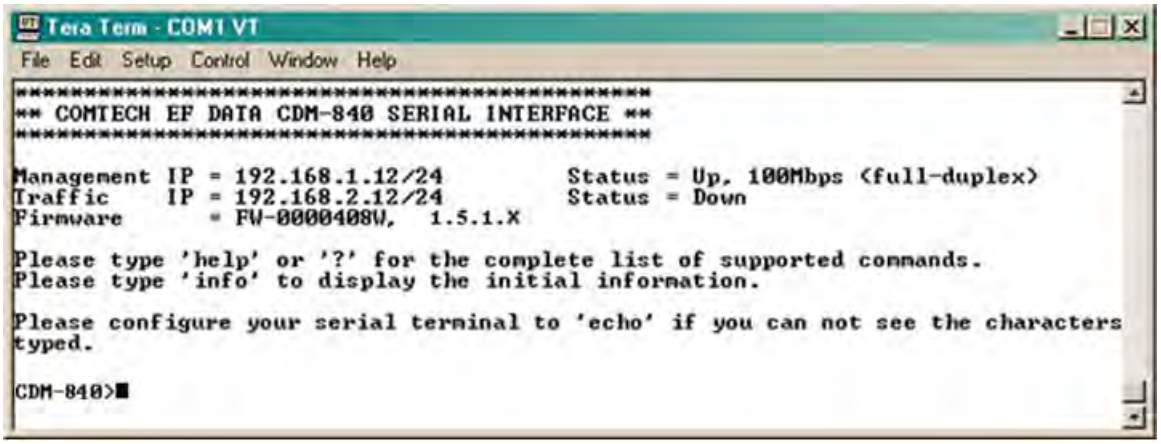
6.2 Ethernet Management Interface Protocols

The user PC facilitates access to Ethernet-based remote monitor and control (M&C) of the CDM-840 through two separately-operated protocols:

- **Simple Network Management Protocol (SNMP).** This *non-secure interface* requires a user-supplied Network Management System (NMS) and a user-supplied Management Information Base (MIB) File Browser.

- **The CDM-840 Web Server (HTTP) Interface.** This *non-secure interface* requires a compatible user-supplied Web browser such as Internet Explorer.

6.2.1 Ethernet Management Interface Access



Access to the CDM-840 Ethernet Management Interface requires you to specify the unit Management IP Address. This address may be obtained from the CDM-840 Serial Interface, upon power-up of the unit, via use of a terminal emulator connected with a user-supplied adapter cable to the 19-pin serial '**CONSOLE/ REDUNDANCY'** port. As shown, a number of operational parameters (including the unit factory-default IP addresses) are displayed.

The default (factory-assigned) IP addresses are provided in the table that follows (if otherwise assigned, you may use the last column to write down the IP addresses for future reference):

Description	Default Address	User-assigned Address
Management IP Address	192.168.1.12	_____
Traffic | GE (GigE) IP Address	10.10.3.12	_____

See* Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT *for details on setting up and using the CDM-840 Serial Interface.

6.3 SNMP Interface

The *Simple Network Management Protocol* (SNMP) is an Internet-standard protocol for managing devices on IP networks. An SNMP-managed network consists of three key components:

- **The managed device.** This includes the CDM-840 Outdoor Remote Router.
- **The SNMP Agent.** The software that runs on the CDM-840. The CDM-840 SNMP Agent supports both **SNMPv1** and **SNMPv2c**.
- **The user-supplied Network Management System (NMS).** The software that runs on the manager.

6.3.1 Management Information Base (MIB) Files

MIB files are used for SNMP remote management of a unique device. A MIB file consists of a tree of nodes called Object Identifiers (OIDs). Each OID provides remote management of a particular function. These MIB files should be compiled in a user-supplied MIB Browser or SNMP Network Monitoring System server. The following MIB files are associated with the CDM-840:

MIB File/Name (where 'x' is revision letter)	Description
ComtechEFData.mib ComtechEFData Root MIB file	ComtechEFData MIB file gives the root tree for ALL Comtech EF Data products and consists of only the following OID: Name: comtechEFData Type: MODULE-IDENTITY OID: 1.3.6.1.4.1.6247 Full path: iso(1).org(3).dod(6).internet(1).private(4).enterprises(1).comtechEFData(6247) Module: ComtechEFData
FW-0000407x_CDM840.mib CDM-840 MIB file	MIB file consists of all of the OIDs for CDM-840 M&C

6.3.2 SNMP Community Strings

In SNMP v1/v2c, the SNMP Community String is sent unencrypted in the SNMP packets. Caution must be taken by the network administrator to ensure that SNMP packets travel only over a secure and private network if security is a concern.

The CDM-840 uses Community Strings as a password scheme that provides authentication before gaining access to the CDM-840 Agent MIBs. They are used to authenticate users and determine access privileges to the SNMP Agent.

Type the SNMP Community String into the user-supplied MIB Browser or Network Node Management software.

Two Community Strings are defined for SNMP access:

- Read Community default = public
- Write Community default = private

For proper SNMP operation, the CDM-840 MIB files must be used with the associated version of the CDM-840 Outdoor Remote Router M&C. Refer to the CDM-840 FW Release Notes for information on the required FW/SW compatibility.

6.4 Web Server (HTTP) Interface

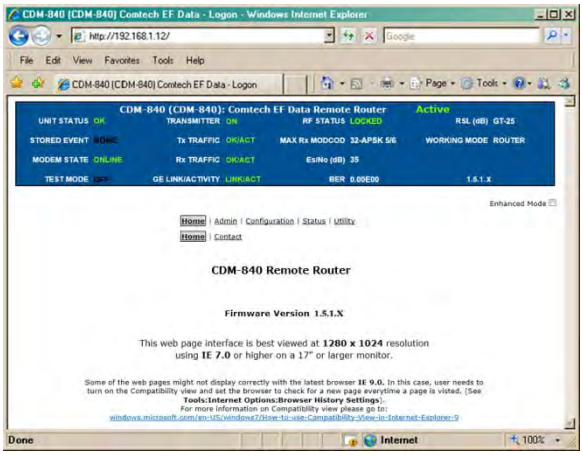
A user-supplied Web browser allows the full monitoring and control (M&C) of the CDM-840 from its Web Server Interface. This non-secure embedded Web application is designed for, and works best with, Microsoft Internet Explorer Version 7.0 or higher.

6.4.1 User Login

Type the CDM-840 Management IP Address (shown here as *http://xxx.xxx.xxx.xxx*) into the **Address** area of the user PC Web browser:

The login page, similar to the example shown here, opens. Enter the assigned **User Name** and **Password** – the default for both is **comtech**. Click **[Log On]**.

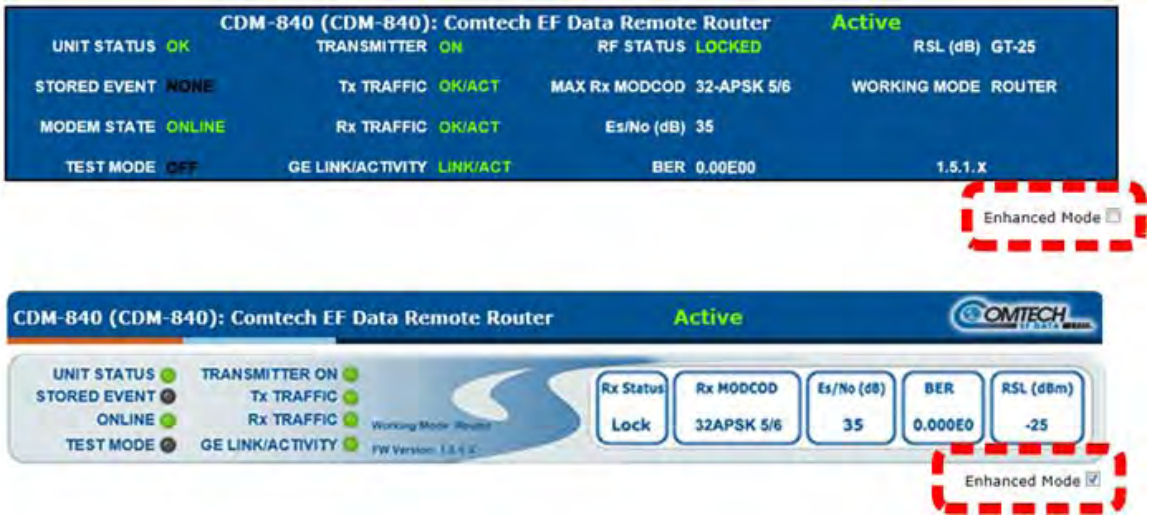
If the User Name and Password are accepted: The CDM-840 Web Server Interface **Home** page, similar to the example shown here, appears:



6.4.2 Web Server Interface – Operational Features

6.4.2.1 Virtual Front Panel

The CDM-840 Web Server Interface features a ***read-only*** 'Virtual Front Panel' (VFP) at the top of each page (**Figure 6-1**). The interface appearance differs based on the selected viewing mode – default or Enhanced Mode.



(TOP) Virtual Front Panel in default mode
(BOTTOM) Virtual Front Panel in Enhanced Mode

Figure 6-1. CDM-840 Outdoor Remote Router Virtual Front Panel

The default viewing mode features a text-based VFP, and hyperlinks for Web page access.

Click the Enhanced Mode check box to change the interface appearance to the GUI viewing format. The Enhanced Mode features virtual LEDs and navigation tabs for Web page access.

For either mode, the VFP provides the following information:

- **At left –** The VFP reports the status of the unit. In either viewing mode, the VFP updates the unit operation indicators in real time. In Enhanced Mode, the VFP emulates the CDM-840 front panel LEDs (explained in detail on the next page).

- **At right –** The VFP displays (and updates in real time) the following parameters:

  - Working Mode (Router or BPM)
  - Firmware Version
  - Rx Status
  - Rx MODCOD
  - EsNo (dB)
  - BER
  - RSL (dBm)

To ensure that your web browser correctly displays the VFP features, Comtech EF Data recommends that you follow these configuration steps (this example uses Microsoft Internet Explorer):

Step	Task
1	On the **Tools** menu, click **Internet Options**.
2	*On the General tabbed page:* Under **Browsing history**, click **[Settings]**.
3	*On the Temporary Internet Files and History Settings page:* Under **Check for Newer Versions of Stored Pages:**, click **Every Time I visit the webpage**.
4	Click **[OK]** to save the selection and close the **Temporary Internet Files and History Settings** page.
5	Click **[OK]** to close the **Internet Options** page.
6	Restart your browser.

The Enhanced Mode virtual LEDs indicate the active operating state of the unit as follows:

LED	Condition	
UNIT STATUS	Green	No Unit Faults or Alarms.
	Amber	No Unit Faults, but an Alarm exists.
	Red	A Unit Fault exists (Example: PSU fault).
STORED EVENT	Amber	There is a Stored Event in the log, which can be viewed from the Web Server Interface
	Off	There are no Stored Events.
ONLINE	Green	The Unit is On Line, and carrying traffic.
	Off	The Unit is Off Line (standby) – forced by externally connected 1:1 or 1:N redundancy system.
TEST MODE	Amber	A Test Mode is selected
	Off	There is no Test Mode currently selected.
TRANSMITTER ON	Green	The Transmitter Carrier is On.
	Red	A Fault exists that causes the unit to turn off the carrier.
	Off	The Transmitter Carrier is Off.
Tx TRAFFIC	Green (solid)	No Tx Traffic Faults, no packets.
	Green (blinking)	No Tx Traffic Faults, blinks when a packet is being transmitted to the satellite link from this unit.
	Amber	A Tx Traffic Alarm exists.
	Red	Tx Traffic has a Fault.
	Off	A Tx Traffic Fault exists.
Rx TRAFFIC	Green (solid)	No Rx Traffic Faults (demod and decoder are locked, everything is OK).
	Green (blinking)	No Rx Traffic Faults, blinks when a packet is being received from the satellite link to this unit.
	Amber	Rx Traffic has an Alarm.
	Red	Rx Traffic has a Fault.
	Off	An Rx Traffic fault exists (the demod may still be OK).
GE LINK/ACTIVITY	Green (solid)	Traffic Ethernet is connected, but no traffic exists.
	Green (blinking)	Ethernet activity detected.
	Off	Traffic Ethernet is not connected.

6.4.2.2 Navigation

The CDM-840 Web Server Interface provides navigation aids at the top of each page, just below the Virtual Front Panel:

- **In default mode, hyperlinks are provided.** After you click a navigation hyperlink, you may click an available primary page hyperlink. In turn, any nested hyperlinks appear for further selection.

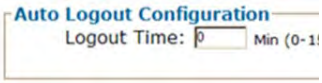
- **In Enhanced Mode, navigation tabs are provided.** After you click a navigation tab, you may click an available primary page tab. In turn, any nested tabs appear for further selection.

This manual uses a naming format for all Web pages to indicate the depth of navigation needed to view the subject page: "**Top Level Select | Primary Page Select | Nested Page Select**".

For example, "**Status | Statistics | Traffic**" instructs you to "*first* click the top-level '**Status**' navigation tab; *then*, click the '**Statistics**' primary page tab; *finally*, click the nested '**Traffic**' tab."

6.4.2.3 Page Sections

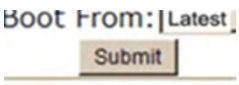
Each page features one or more sections. The title at the top of each page or page section indicates its function. Each section can feature editable fields, action buttons, and read-only displays that are specific to that function.



This manual explains the purpose and operation for each Web page on a ***per-page, per-section*** basis.

6.4.2.4 Action Buttons

Action buttons are important in the Web Server Interface. Click an action button to do one of these tasks:

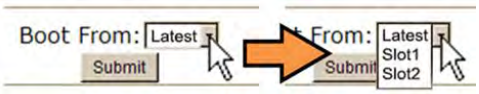


- Reset changed parameters to remove ***unsaved*** changes.
- Permanently save changes.
- Refresh the page with current data.

If you edit a field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are <u>not</u> saved.

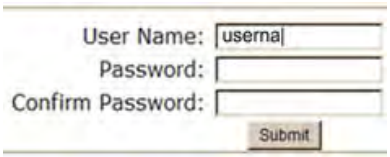
6.4.2.5 Drop-down Lists

A drop-down list lets you choose from a list of selections. Left-click the drop-down button to open the list. Then, left-click on an item to select that choice.



6.4.2.6 Text or Data Entry

Text boxes let you type data into a field. An action button may be associated with a single text box, or a group of text boxes. For any text box, left-click anywhere inside the box, type the desired information into that field, and be sure to press **[ENTER]** when done.



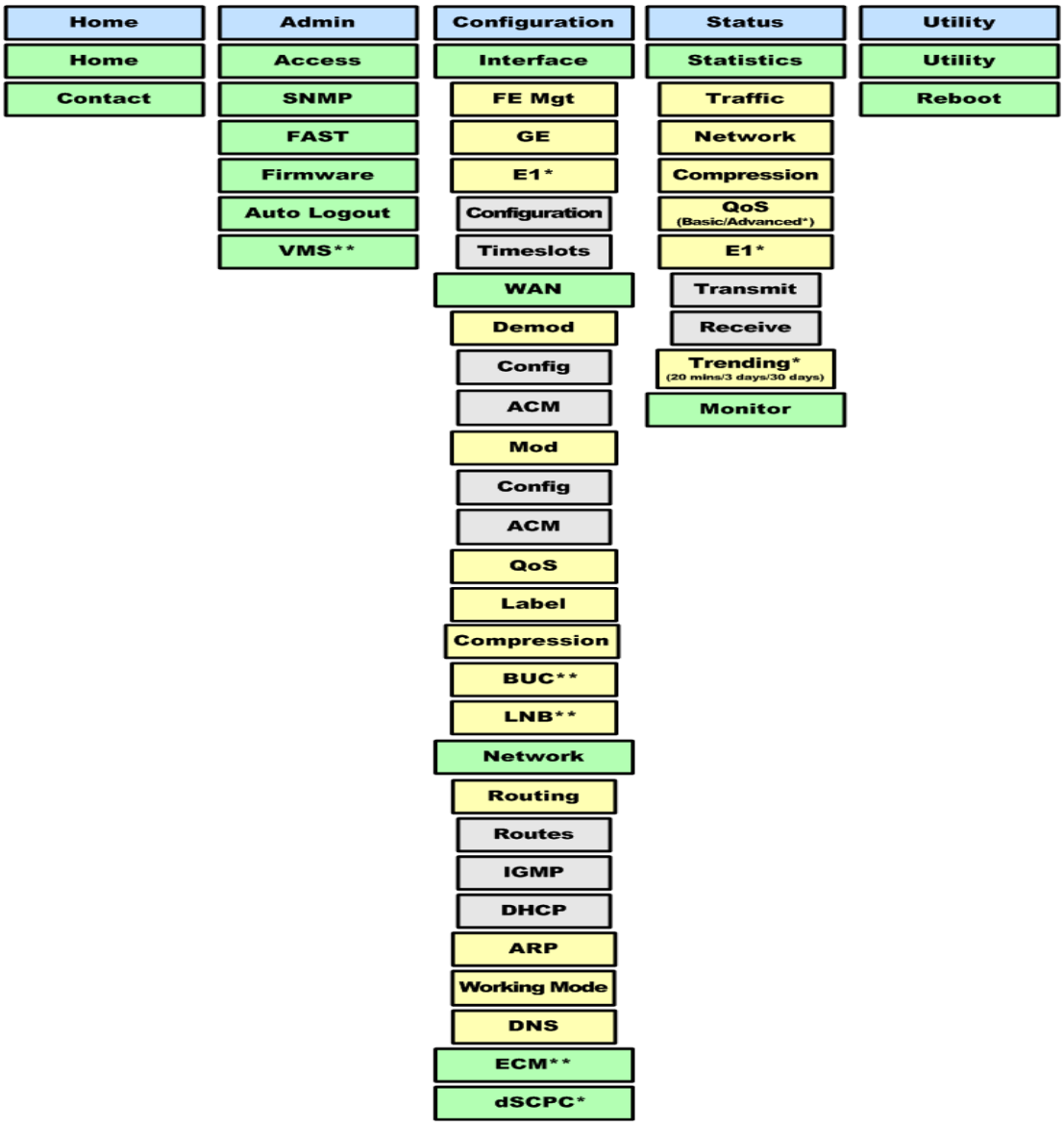
Click the related action button to save the data.

If you edit any field, make sure to click the action button before you leave the page. If you go to another page without first clicking the action button, your changes are not saved.

6.4.3 Web Server Interface – Menu Tree

1. ***Any diagram block that is marked with (*) denotes a page that is functional only when that particular FAST feature has been purchased and activated. Diagram blocks marked with (**) denote pages that are functional only when a VIPERSAT MANAGEMENT SYSTEM (VMS), and a Block Upconverter (BUC) OR a Low Noise Block Downconverter (LNB) is installed and is recognized as operational.***

2. ***E1 Interface operation is not available with the CDM-840 Reduced Form Factor Outdoor Remote Router.***



The CDM-840 Web Server Interface features five navigation tabs (shown in blue) located below the VFD at the top of each page. Primary page tabs (green) and nested page tabs (yellow and gray) provide access to individual Web pages. Click any navigation tab to continue.

6.4.4 Web Server Interface Page Descriptions

1. ***Access to and availability of certain CDM-840 Web Server Interface pages is dependent upon the FAST options purchased for operation as well as the detected presence of auxiliary products (e.g., VMS, Redundancy Switches, LNBs or BUCs, etc.) installed and configured for use with the CDM-840. Such operational restrictions are noted through the remainder of this chapter.***

2. ***The page figures that follow depict the Web Server Interface pages with Enhanced Mode selected.***

6.4.4.1 Home Pages

Click the **Home** tab, and then select the **Home** or **Contact** tab to continue.

6.4.4.1.1 Home | Home

Use this page to identify the product and its current operating firmware version. Click the **Home** navigation tab and/or the nested page tab to return to this page from anywhere in the Web Server Interface.

Figure 6-2. CDM-840 Outdoor Remote Router Home Page

6.4.4.1.2 Home | Contact

For all product support, please call:

+1.240.243.1880

+1.866.472.3963 (toll free USA)

6.4.4.2 Admin (Administration) Pages

Use these pages to set up user access, manage the firmware load preferences, and activate FAST features.

Click the **Admin** tab, and then select the **Access**, **SNMP**, **FAST**, **Firmware**, **Auto Logout**, or **VMS** tab to continue.

6.4.4.2.1 Admin | Access

The Administrator must use this page to manage the CDM-840 Web Server Interface user access settings.

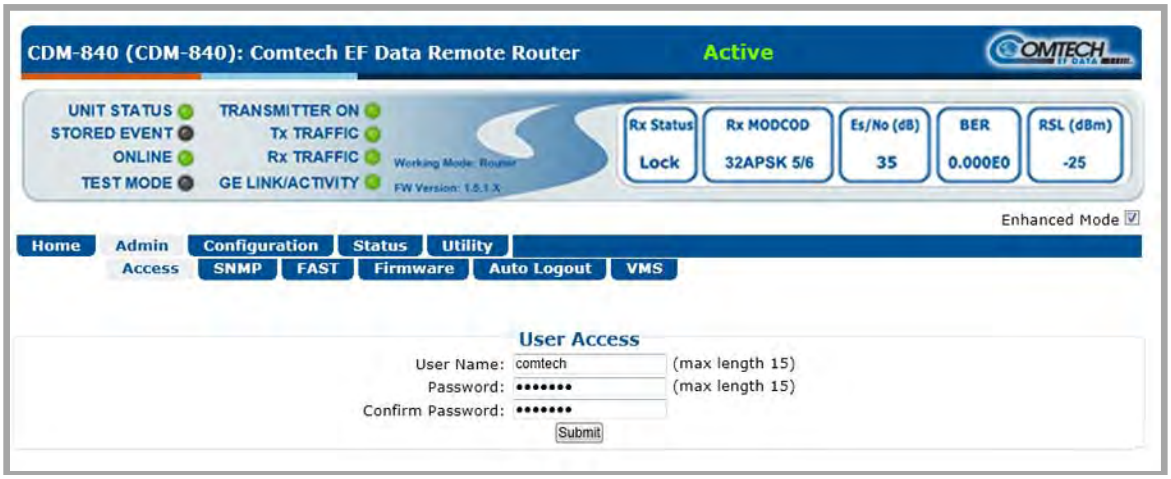


Figure 6-3. Admin | Access Page

User Access

- Enter a **User Name**. The **User Name** can be any alphanumeric combination with a maximum length of 15 characters. The factory default is **comtech**.
- Enter a **Password**. The **Password** can be any alphanumeric combination with a maximum length of 15 characters. The factory default is **comtech**.
- Re-enter the new **Password** in the **Confirm Password** text box.

Click **[Submit]** to save.

6.4.4.3 Admin | SNMP

Sect. 6.3 SNMP Interface

The Administrator must use this page to manage the CDM-840 SNMP (Simple Network Management Protocol) settings.

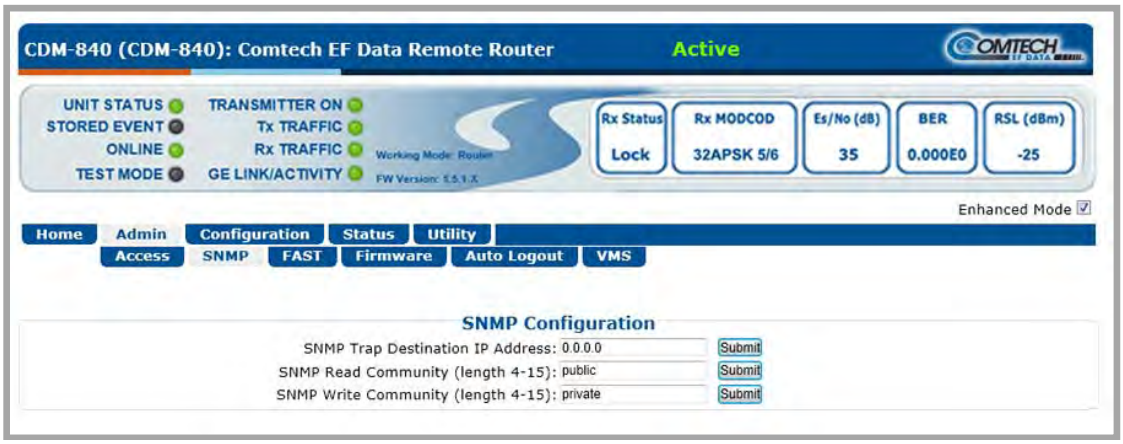


Figure 6-4. Admin | SNMP Page

SNMP Configuration

- Enter the **SNMP Trap Destination IP Address**, in the form XXX.XXX.XXX.XXX, of the computer that is to receive the traps generated by the CDM-840.

Click **[Submit]** to save.

- Enter an **SNMP Read Community** string. The SNMP Read Community string can be any combination of characters and a length from **4** to **15** characters. The factory default SNMP Read Community string is **public**.

Click **[Submit]** to save.

- Enter an **SNMP Write Community** string. The SNMP Write Community string can be any combination of characters and a length from **4** to **15** characters. The factory default SNMP Write Community string is **private**.

Click **[Submit]** to save.

6.4.4.3.1 Admin | FAST

See* Chapter 5. FAST ACTIVATION PROCEDURE *for complete details and instructions for upgrading the CDM-840 Remote Router FAST features.

1. ***Tx Header and Payload Compression and Quality of Service (QoS)/Advanced QoS are standard (non-FAST) operational features for Comtech EF Data's Advanced VSAT Series group of products. If these features are listed in the FAST Configuration table, they are always indicated as Enabled.***

2. ***PTP is not available in this firmware release. Once operable, this protocol will be used to synchronize clocks throughout a computer network. When the hardware required for this option is not installed in the CDM-840, the Web page displays the message "*PTP not supported with installed hardware*".***

3. ***E1 Interface operation is not available with the CDM-840 Reduced Form Factor Outdoor Remote Router***

The CDM-840 has a number of optional features that may be activated after purchase of the unit. **F**ully **A**ccessible **S**ystem **T**opology (**FAST**) **Access Codes** are unique authorization codes that may be purchased from Comtech EF Data during normal business hours, and then loaded into the unit using this page.

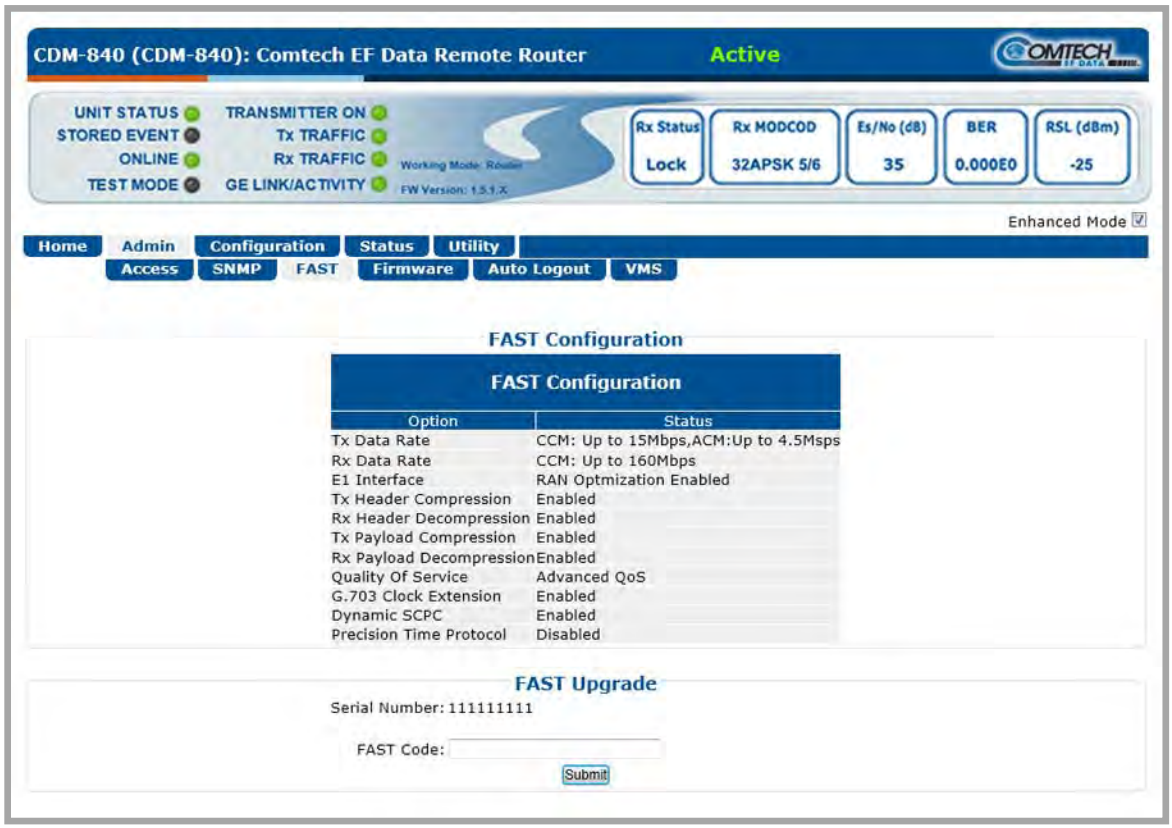


Figure 6-5. Admin | FAST Page

6.4.4.4 Admin | Firmware

Chapter 4. UPDATING FIRMWARE

Use this page to select which image (boot Slot #) is to be designated as the *active running firmware image* – i.e., the version loaded for operation upon power-up or soft reboot.

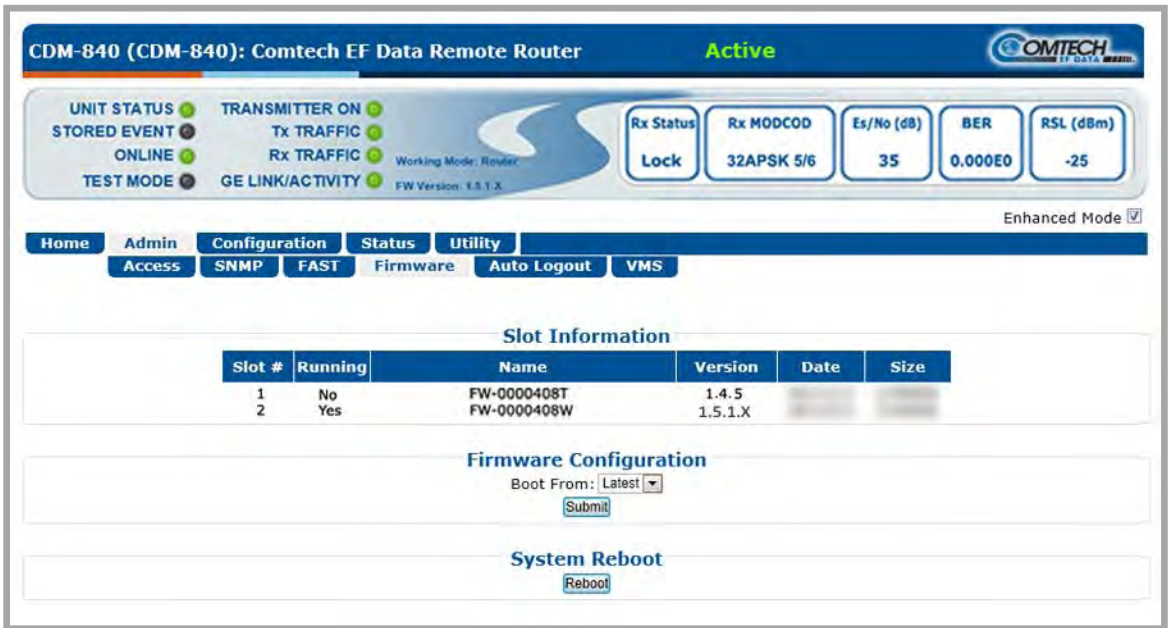


Figure 6-6. Admin | Firmware Page

Slot Information

This ***read-only*** status section displays operating status for the firmware versions loaded into Slot #1 and Slot #2.

Firmware Configuration

Use the **Boot From:** drop-down list to select **Latest**, **Slot 1**, or **Slot 2**. The default selection is **Latest,** in which the unit will automatically select the image that contains the most current firmware.

Click **[Submit]** to execute the desired firmware boot preference.

(Note that the Slot Information section, which in the above example displays Slot #1 as the designated *active running firmware image*, will *not* update until *after* the unit is rebooted.)

System Reboot

Click **[Reboot]** to reboot the CDM-840. Once the unit reboots, you must log in once again to resume use of the Web Server Interface. See the **Utility | Reboot** page (**Sect. 6.4.4.7.2**) for complete details about the reboot process.

6.4.4.4.1 Admin | Auto Logout

Use this page to incorporate the Auto Logout security measure.

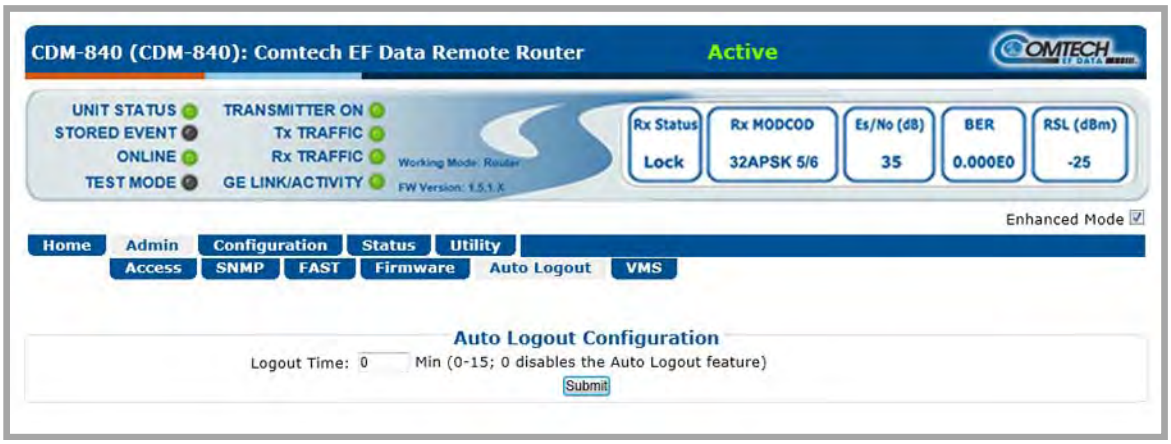


Figure 6-7. Admin | Auto Logout Page

Auto Logout Configuration

Set an automatic logout time to safeguard access to an already logged-in unit:

- Enter a value from **1** to **15** minutes into the **Logout Time** box to configure this feature.
- Enter a value of **0** to disable this feature.

Click **[Submit]** to save the desired configuration.

With Auto Logout configured, the active session terminates if the unit remains idle (i.e., when no user activity occurs) beyond the assigned Logout Time. A valid user name and password is then required to resume the CDM-840 Web Server Interface session.

6.4.4.4.2 Admin | VMS

VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)

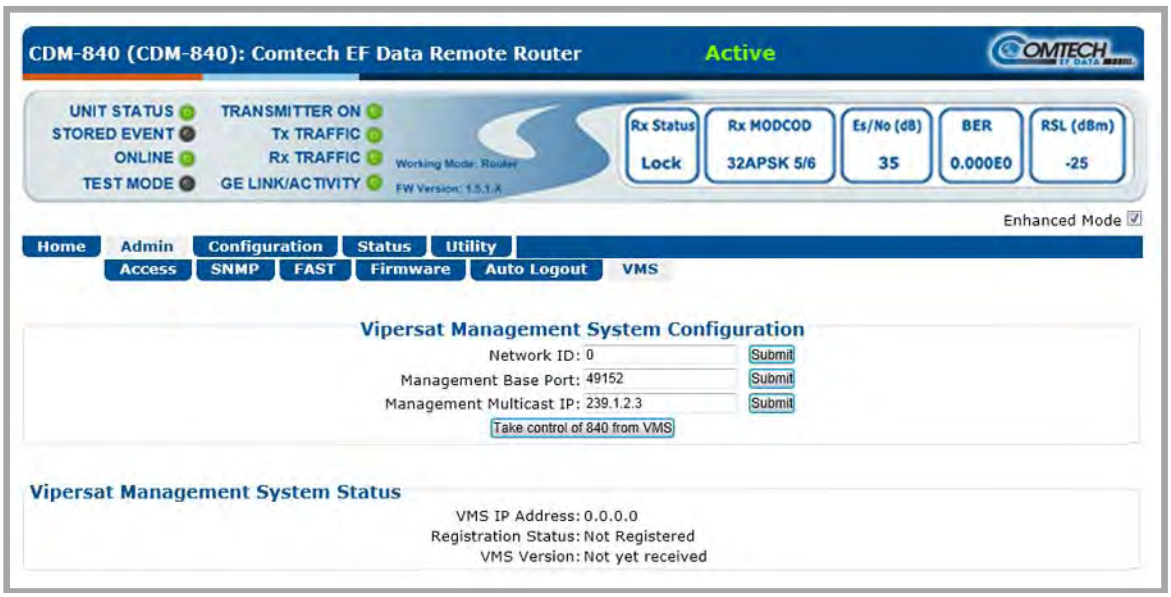


Figure 6-8. Admin | VMS Page

Vipersat Management System Configuration

The acceptable/valid operating ranges for items in this section are provided in parentheses.

- **Network ID** (1-254) – The **Network ID** designation defines to which network the CDM-840 belongs. All devices in a common network will have the same network ID. The network ID is used by the VMS to identify Vipersat units within a network and allows the VMS to manage multiple networks, each with its own unique network ID number.

- **Management Base Port** – The **Management Base Port** sets the starting IP port addressing for all VM, ACM, and CDRP messages.

  - ***Use this setting ONLY if network port addressing is in contention. Otherwise, leave this setting at default (hex) C000 (des) 49152 to avoid unnecessary configuration changes.***

  - ***Changing this port number will affect internal management operations across the entire network, requiring configuration changes to all modems.***

  - ***While this page is functional only when the optional VIPERSAT MANAGEMENT SYSTEM (VMS) is installed and operational, the Management Base Port number is essential to proper operations with or without the VMS feature.***

- **Management Multicast IP Port** – The Multicast Address is the NMS Multicast IP address assigned to all CDM-840s in the Vipersat network that are managed by the VMS. This address must match the VMS Transmit Multicast Address.

Typical for each item, click **[Submit]** to save.

Once the modem is registered in the Vipersat network, the VMS takes full management control of the *Data Rate, Symbol Rate, FEC Type, Tx Frequency, MODCOD, Power Leve*l, and *Carrier State* modulator parameters. Click **[Take control of 840 from VMS]** to override the VMS control function.

Vipersat Management System Status

This ***read-only*** section provides available information on the VMS IP Address, Registration Status, and Version.

6.4.4.5 Configuration Pages

1. ***The BUC and LNB tabs are functional ONLY when those optional products are installed.***

2. ***Precision Time Protocol is not available in this firmware release. The PTP tab, while available and selectable on this interface, is therefore non-functional.***

Use the nested Configuration pages to configure all unit parameters. Dependent on availability, first click the **Configuration** tab, and then select the **Interface**, **WAN**, **Network**, **ECM**, or **dSCPC** tab to continue.

6.4.4.5.1 Configuration | Interface Pages

Click the **Configuration | Interface** tabs, and then select the **FE-Mgt, GE,** or **E1** tab to continue.

6.4.4.5.1.1 Configuration | Interface | FE-Mgt

1. ***The IP Addresses for the FE and GigE Interfaces must be different and on separate subnets.***
2. ***The FE Management port will always be in Router Mode. The Traffic Port will change from Router Mode to BPM Mode when the Working Mode is changed.***

Use this page to configure the rear panel '**MANAGEMENT | FE**' (10/100 BaseT Fast Ethernet) M&C port. Note that this port serves as the dedicated Ethernet-based monitor and control interface between the CDM-840 and the user PC.

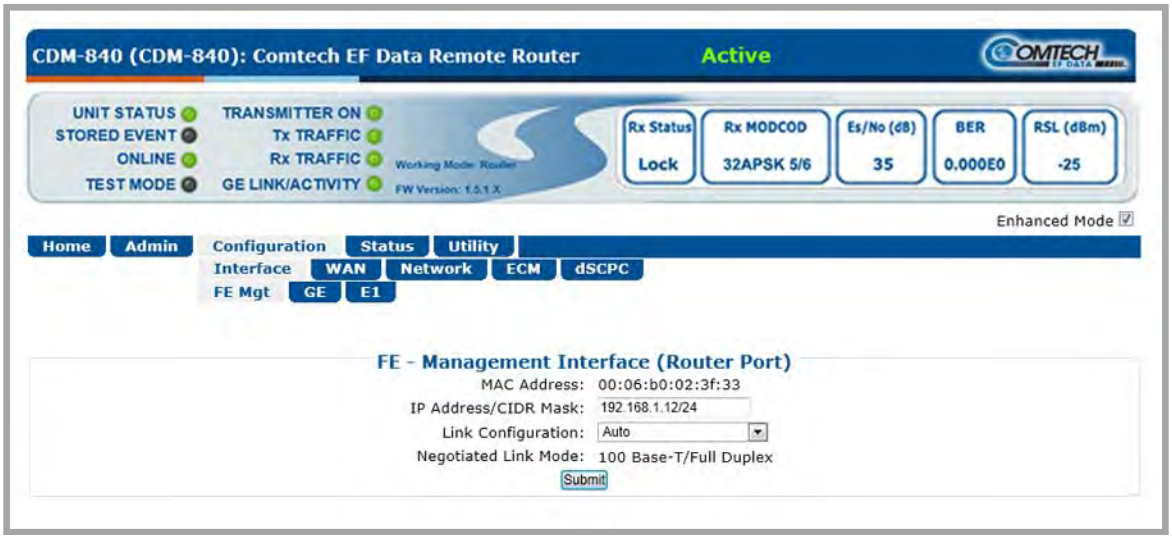


Figure 6-9. Configuration | Interface | FE-Mgt Page

FE – Management Interface

The acceptable/valid operating ranges for items in this section are provided in parentheses.

- **MAC Address** (*read-only*) – The Ethernet MAC Addresses are configured at the factory and cannot be changed. This address is unique for each available port.

- **IP Address / CIDR Mask** (8 to 30) – Use this box to enter the IP Address and CIDR (**C**lassless **I**nter-**D**omain **R**outing) Subnet Mask.

  When in Router Mode, the configured subnets must be unique. Overlapping the subnets will not be allowed and the requested configuration will be rejected.

- **Link Configuration** – Use the drop-down list to select the line speed and duplex setting for the CDM-840 FE interface. The available selections are:

  - **Auto***
  - 100 BaseT / Full Duplex
  - 10 BaseT / Full Duplex
  - 100 BaseT / Half Duplex
  - 10 BaseT / Half Duplex

  ***** Auto *is the recommended configuration selection.***

- **Negotiated Link Mode** (*read-only*) – The actual negotiated line speed and duplex setting for the FE Interface is displayed here. The viewable settings are:

  - 10 BaseT / Full Duplex
  - 100 BaseT / Full Duplex
  - 10 BaseT / Half Duplex
  - 100 BaseT / Half Duplex

Click **[Submit]** to save.

6.4.4.5.1.2 Configuration | Interface | GE

1. ***The IP Addresses for the FE and GigE Interfaces must be different and on separate subnets.***
2. ***The GE port will not have an IP address when BPM Working Mode is active.***

Use this page to configure the rear panel '**GE**' 10/100/1000 BaseT Gigabit Ethernet port. This port should be connected to the user LAN network, and is used for user Ethernet traffic.

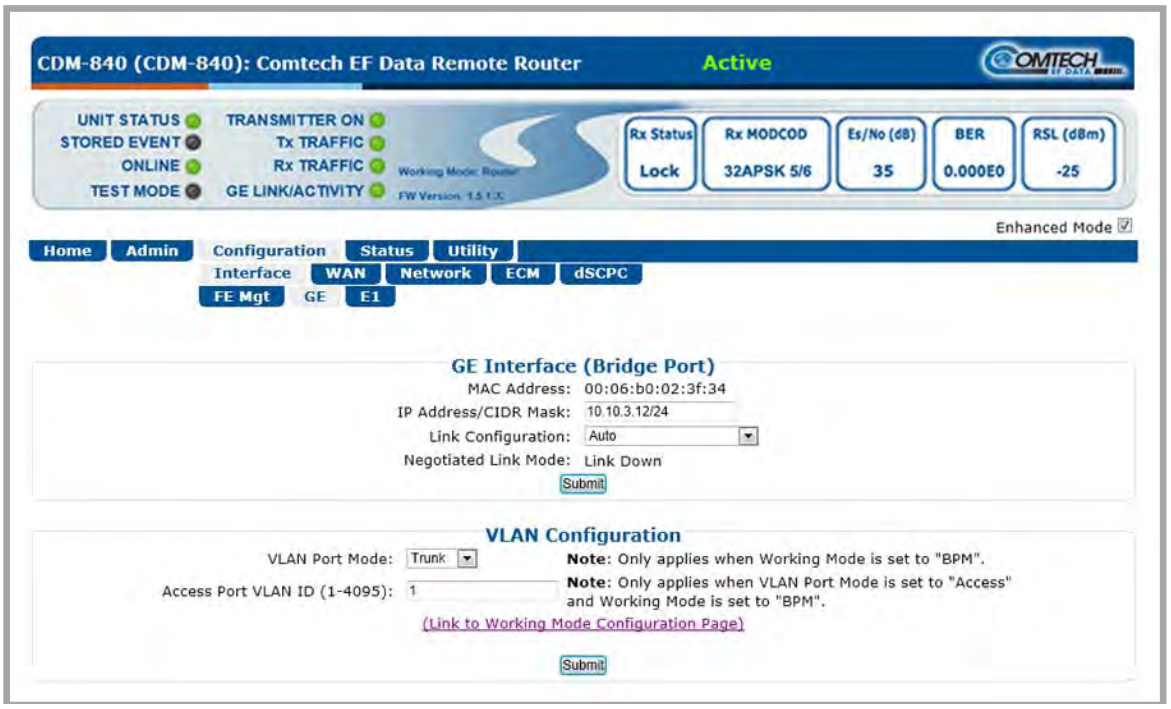


Figure 6-10. Configuration | Interface | GE page

GE Interface

The ***read-only*** information and configuration options provided here are identical to those featured on the '**Configuration | Interface | FE Mgt**' page. See **Sect. 6.4.4.5.1.1** for information about using these features.

VLAN Configuration

Appendix C. BRIDGE POINT-TO-MULTIPOINT (BPM) OPERATION

VLAN Port Mode – This setting applies only when the Working Mode is set to BPM. Use the drop-down list to select the port mode as **Trunk** or **Access**. Note the following:

- VLAN Trunk Mode is the default mode for BPM where all packets (with and without VLAN tags) arriving at the CTOG-250 and CDM-840 pass through the system without modification. A trunked port can pass two or more VLANs on the interface.

- VLAN Access Mode forces the Traffic Interface to carry traffic for only one user-configured VLAN.

Access Port VLAN ID – Enter a valid numeric port ID, from 1 to 4095. This ID is valid only when Working Mode is set as **BPM** and the VLAN Port Mode is set to **Access**.

When the VLAN Port Mode is set to **Access**, VLAN tagged packets from WAN to LAN having a VLAN ID that matches the "Access Port VLAN ID" will have the outer VLAN tag removed and then transmitted by the Traffic port. In this mode, packets coming in to the Traffic port in this mode will be tagged with the "Access Port VLAN ID". If the outermost VLAN tag IDs for WAN to LAN packets do not match the "Access Port VLAN ID", they will be dropped.

Click the **(Link to Working Mode Configuration Page)** hyperlink to access the **Configuration | Network | Working Mode** page (**Sect. 6.4.4.5.3.3**).

Click [Submit] to save.

6.4.4.5.1.3 Configuration | Interface | E1 Pages

Appendix G. WAN/RAN OPTIMIZATION

These pages are functional only when the 'G.703 E1 Interface / RAN Optimization' FAST and hardware options are installed and activated.

Click the **Configuration | Interface | E1** tabs, and then select the **Configuration** or **Time Slots** tab to continue.

6.4.4.5.1.3.1 Configuration | Interface | E1 | Configuration

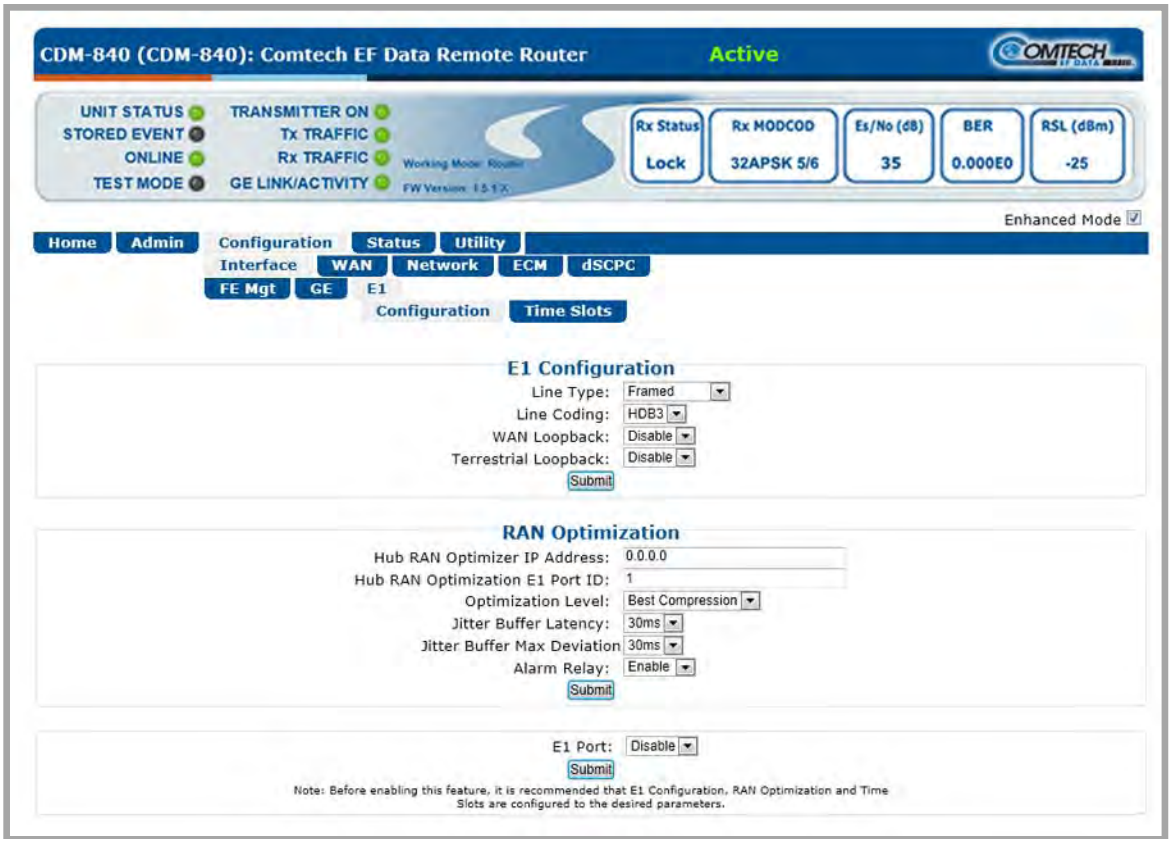


Figure 6-11. Configuration | Interface | E1 | Configuration Page

E1 Configuration

- **Line Type** – Use the drop-down list to select this parameter as **Framed**, **Framed-CRC**, or **Unframed**.
- **Line Coding** – Use the drop-down list to select this parameter as **HDB3** or **AMI**.
- **WAN Loopback** and **Terrestrial Loopback** – Use the drop-down lists to set these parameters as either **Disable** or **Enable.**

Click **[Submit]** to save any changes made to the E1 Configuration settings.

RAN Optimization

Appendix G. WAN/RAN OPTIMIZATION

Use RAN Optimization to reduce the satellite bandwidth required for mobile backhaul. Use this section to select the level of optimization needed to achieve the desired link quality and bandwidth savings.

- **Hub RAN Optimizer IP Address** – Enter an IP address in the form XXX.XXX.XXX.XXX.

- **Hub RAN Optimization E1 Port ID** – Enter a numeric identification string for the '**G.703 | IN / OUT**' port pair, corresponding to a specified, corresponding port on the CXU-810 RAN Optimizer.

- **Optimization Level** – Use the drop-down list to set this parameter as **Best Performance** or **Best Compression**.

- **Jitter Buffer Latency** – Use the drop-down list to set this parameter as **10ms**, **20ms**, **30ms**, **40ms**, or **50ms**.

- **Alarm Relay** – Use the drop-down list to select as **Disable** or **Enable**. Selecting **Enable** will both trigger the logging of operational faults or alarms on the **Status | Statistics | E1 | Transmit** / **Receive page**s and toggles ***on*** the **STORED EVENT** LED on the Web Server Interface Virtual Front Panel (**Sect. 6.4.2.1**).

Click **[Submit]** to save any changes made to the RAN Optimization settings.

E1 Port

By default, access to G.703 Clock Extension operation defaults to **Enabled** when this FAST option is activated. Use the **E1 Port** drop-down list to otherwise elect ***Disable***.

Click **[Submit]** to save.

6.4.4.5.1.3.2 Configuration | Interface | E1 | Time Slots

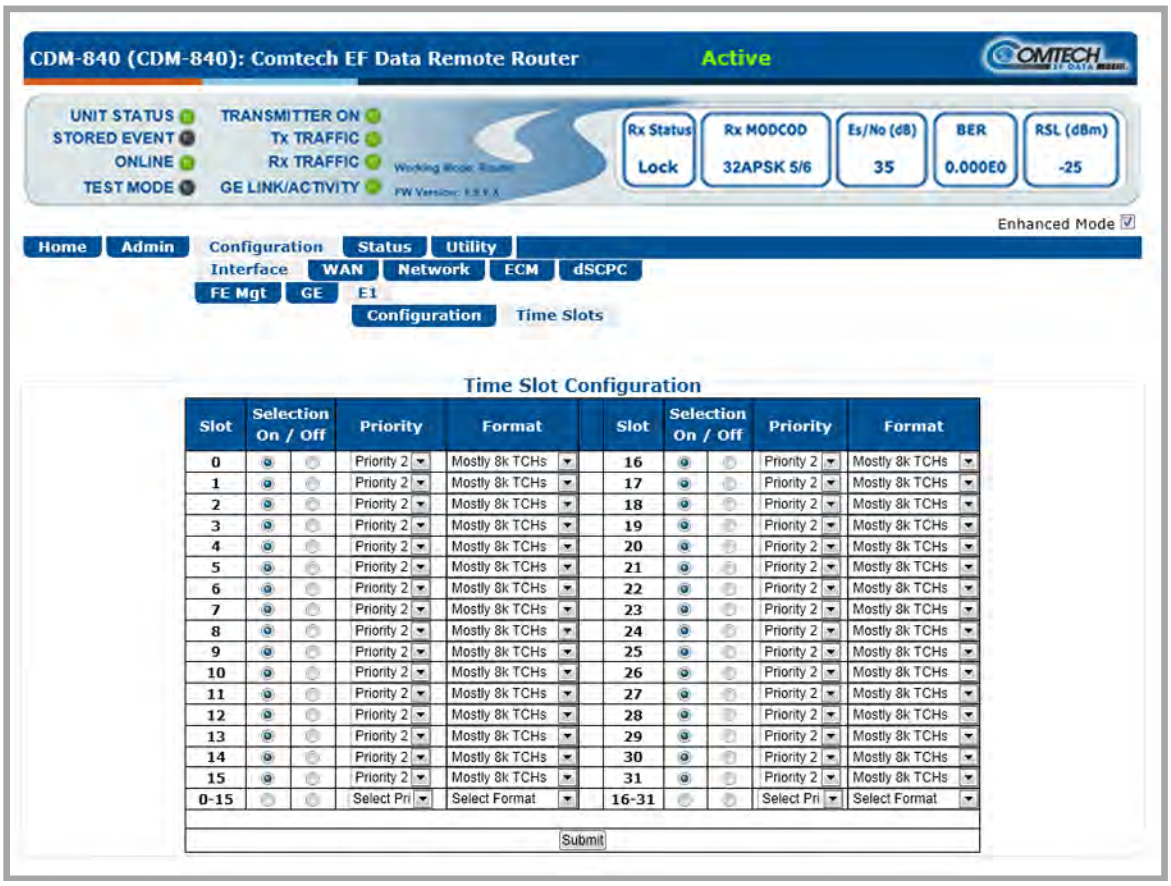


Figure 6-12. Configuration | Interface | E1 | Time Slots Page

Time Slot Configuration

Time Slots may be selected for transmission or reception up to the maximum dictated by the selected transmit or receive data rate, and may be selected in prioritized order. For example, if the Time Slot format is set to **Mostly 64k TCHs (Time Channels)**, the maximum number of Time Slots that can be dropped or inserted is 64 kbps. *From left to right:*

Column	Description
Slot	*(Read-only)* This column identifies the assignable Time Slot (0 through 31).
Selection On / Off	Select this Time Slot as On or Off.
Priority	Use the drop-down list to select this Time Slot priority as Priority 1, Priority 2, or Priority 3.
Format	Use the drop-down list to select this Time Slot format: • Mostly 8k TCHs • Mostly 16k TCHs • Mostly 32k TCHs • Mostly 64k TCHs

Click **[Submit]** to save.

6.4.4.5.2 Configuration | WAN Pages

The BUC and LNB tabs are functional ONLY when those optional products are installed.

Click the **Configuration | WAN** tabs, and then select the **Demod**, **Mod**, **QoS**, **Label**, **Compression**, **BUC**, or **LNB** tab to continue.

6.4.4.5.2.1 Configuration | WAN | Demod (Demodulator) Pages

Click the **Configuration | WAN | Demod** tabs, and then select the **Config** or **ACM** tab to continue.

6.4.4.5.2.1.1 Configuration | WAN | Demod | Config

Use this page to configure CDM-840 Rx demodulator operations.

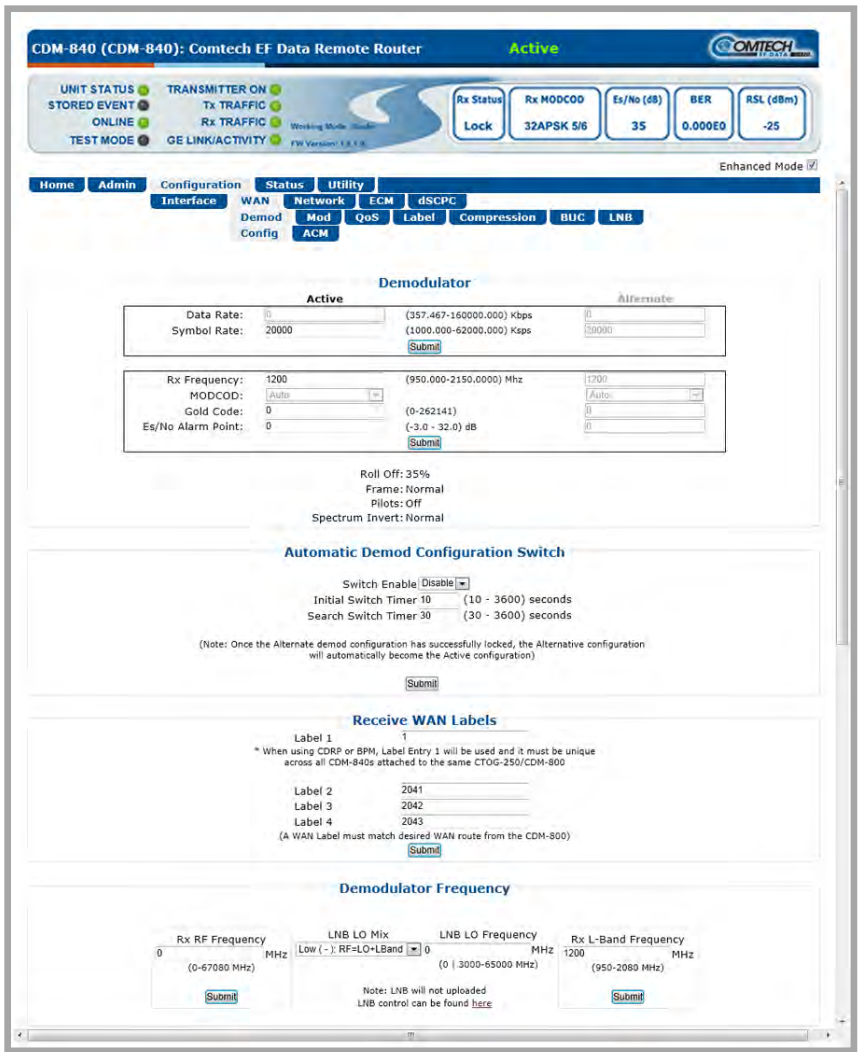
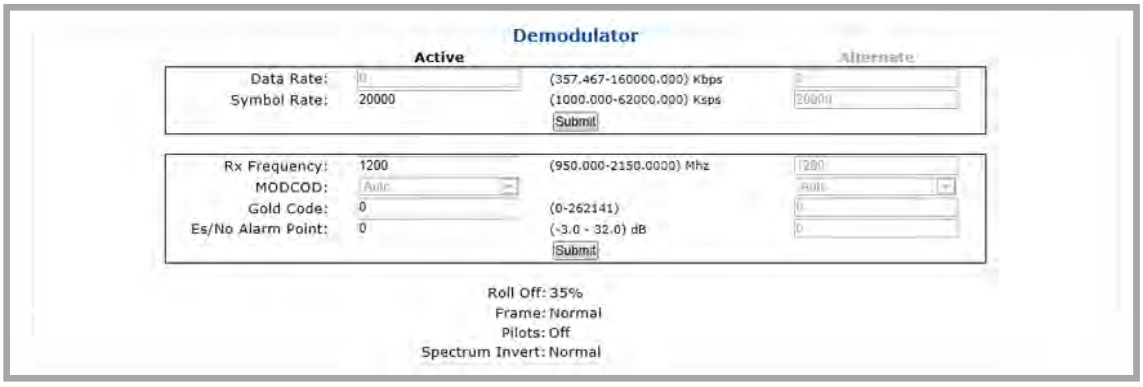


Figure 6-13. Configuration | WAN | Demod | Config Page

Demodulator



The upper range of Symbol Rate selection requires activation of the* RECEIVE SYMBOL RATE *FAST option.

The acceptable/valid operating range for each item in this section is provided in parentheses.

- **Data Rate** (*read-only*) – This section displays the data rate, which is a snap shot of the MODCOD currently being received.

- **Symbol Rate** (1000 to 62000) – Enter the Active and Alternate symbol rates in **ksps**.

Click **[Submit]** to save.

***The* Alternate *column and its defined Symbol and Data rates are used only when the* Automatic Demod Configuration Switch *has been* enabled.**

- **Rx Frequency** (950 to 2150 MHz) – Enter the Active and Alternate Rx frequencies in MHz.

- **MODCOD –** Use the drop-down lists to select the FEC rate (**MODCOD**). The available selections are:
  - **Auto***
  - DVB-S2 QPSK 1/4
  - DVB-S2 QPSK 1/3
  - DVB-S2 QPSK 2/5
  - DVB-S2 QPSK 1/2
  - DVB-S2 QPSK 3/5
  - DVB-S2 QPSK 2/3
  - DVB-S2 QPSK 3/4
  - DVB-S2 QPSK 4/5
  - DVB-S2 QPSK 5/6
  - DVB-S2 QPSK 8/9
  - DVB-S2 QPSK 9/10
  - DVB-S2 8-PSK 3/5
  - DVB-S2 8-PSK 2/3
  - DVB-S2 8-PSK 3/4
  - DVB-S2 8-PSK 5/6
  - DVB-S2 8-PSK 8/9
  - DVB-S2 8-PSK 9/10
  - DVB-S2 16-APSK 2/3
  - DVB-S2 16-APSK 3/4
  - DVB-S2 16-APSK 4/5
  - DVB-S2 16-APSK 5/6
  - DVB-S2 16-APSK 8/9
  - DVB-S2 16-APSK 9/10
  - DVB-S2 32-APSK 3/4
  - DVB-S2 32-APSK 4/5
  - DVB-S2 32-APSK 5/6
  - DVB-S2 32-APSK 8/9
  - DVB-S2 32-APSK 9/10

**** Auto** is the recommended configuration selection.*

- **Gold Code** (000000 to 262141) – The Gold-n Index descrambling code indicates the Physical Layer spreading sequence number. The default setting is all **0**s.

- **Es/No Alarm Point** (0.1 to 16.0) –This value, as calculated by the demodulator, is the energy per symbol bit (Es) divided by the noise spectral density (No). Enter the Es/No Alarm Point value, in dB.

Click **[Submit]** to save.

***The* Alternate *column and its defined Symbol and Data rates are used only when the* Automatic Demod Configuration Switch *has been* enabled.**

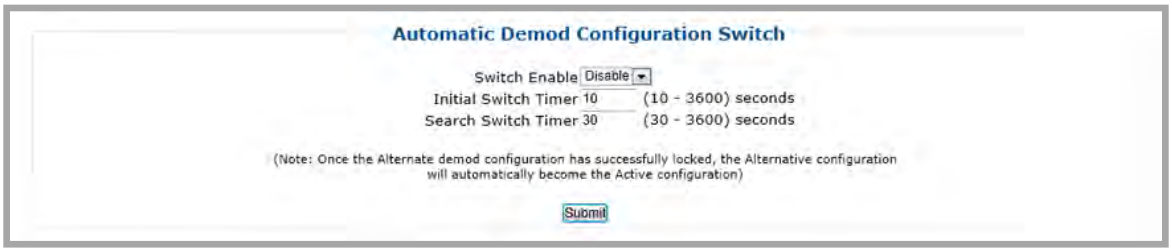
- **Roll Off** (*read-only*) – The Rx Alpha Rolloff **(α)** dictates how fast the spectral edges of the carrier are attenuated beyond the 3 dB bandwidth. Roll Off is identified here as **20%**, **25%**, or **35%**.

- **Frame** (*read-only*) – The Framing type is identified here as either **Normal** or **Auto**.

- **Pilots** (*read-only*) – Pilots operation is identified here as **Off**, **On**, or **Auto**.

- **Spectrum Invert** (*read-only*) – Spectrum Inversion operation is identified here as either **Normal** or **Rx Spectrum Inverted**.

Automatic Demod Configuration Switch



The Automatic Demod Configuration Switch allows the user to enable and configure the "Alternate Demod" functionality. The primary purpose of this functionality is allow a user to pre-stage a new configuration for the outbound carrier – i.e., increase, decrease, or move the CTOG-250's Outbound carrier. It is expected that this will be done as part of normal operations.

The recommended procedure is as follows:

Step	Task
1	Define the new desired outbound carrier parameters (symbol rate, frequency).
2	Configure the "Alternate Demod" configuration for all CDM-840s on the same Outbound Carrier (CTOG-250).
3	Configure the CTOG-250 to the new matching Tx parameters.
4	At this point, all of the CDM-840s will unlock from the old carrier, wait the "Intitial Switch Timer" seconds and then try to Receive Lock to the "Alternate Demod" configuration.

Step	Task
5	If the initial attempt fails, then the demod will switch back and forth between the Active and the Alternate configuration until lock is achieved. This will occur every "Search Switch Timer" seconds.
6	Once a lock occurs, the successful configuration becomes the "Active" configuration and the other configuration becomes the "Alternate" configuration.

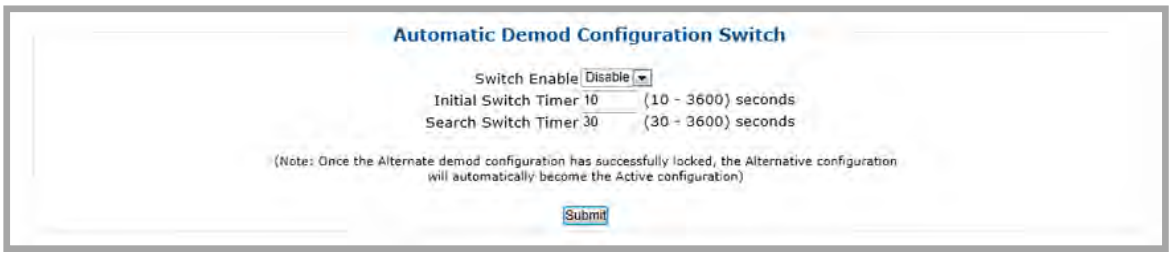
- **Switch Enable** – Use the drop-down list to set automatic switching between demod configurations as **Enable** or **Disable**.

- **Initial Switch Timer** – Enter a value from **10** to **3600** seconds. Use this setting to specify how long to wait after the demod goes unlocked before trying to lock onto the "Alternate Demod" parameters.

- **Search Switch Timers** – Enter a value from **30** to **3600** seconds. Use this setting to specify how long to wait between alternating attempts to "search" for the correct demod configuration. The "search" will stop once the demod has successfully locked onto the CTOG-250's carrier.

Click **[Submit]** to save.

Receive WAN Labels



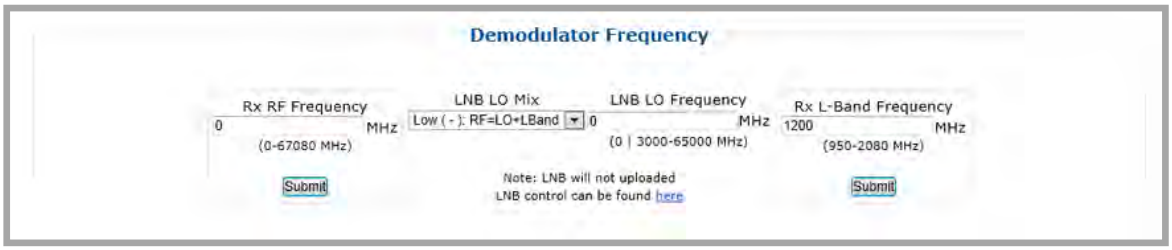
Edit the **Label 1** through **Label 4** text boxes to suit. Each label has a valid range of 1 to 2047.

The assigned Receive WAN Labels must match the WAN Labels assigned on the CTOG-250 Route Table. Note that the preferred method of operation (as required for ACM/VCM Operation) is to configure a unique WAN Label in Entry #1 for each CDM-840 across the network, and then enble CDRP on the CTOG-250. The associated Route to WAN Label will be automatically updated and maintained.

Refer to the CTOG-250 Comtech Traffic Optimization Gateway Installation and Operation Manual (CEFD P/N MN-CTOG250) for the CDM-800 configuration information.

Create the desired labels. Click **[Submit]** to save.

Demodulator Frequency



The Demodulator Frequency Calculator provided here allows you to start from either the Rx RF or Rx L-Band/IF Frequency and calculate the "other" frequency. If the LNB LO Mix, LNB LO Frequency, and one of the desired frequencies are known, then the other can be calculated. This calculator is intended to remove any guesswork associated with the demodulator's L-Band/IF Frequency to the terminal's RF frequency (or vice versa).

The acceptable/valid operating range for each item in this section is provided in parentheses.

- **Rx RF Frequency** (0 to 67080 MHz) – This is the frequency at which the terminal is receiving from the satellite. Upon configuring this to a non-zero value, as well as entering in the LNB LO Mix and Frequency, the demod's L-Band or IF frequency will be automatically configured.

  Enter the Rx RF Frequency in MHz, and then click **[Submit]**. Upon submission, if the LNB LO Frequency has been entered, the resulting Rx RF Frequency will be displayed.

  If the LNB LO Frequency is left at the default configuration of zero, the Rx RF Frequency will not be calculated.

  The LNB LO Mix and LNB LO Frequency entries are provided for calculation purposes only. LNB configuration is not updated as a result of configuring these parameters.

- **LNB LO Mix** – Use this drop-down list to select the LNB LO (Low Oscillator) Mix as **Upconv (SUM): RF=LO+LBand** or **DownConv (Diff): RF=LO-LBand**.

  Please consult the LNB adjunct product datasheet or its Installation and Operation Manual for the type of LNB (Upconverter [Sum] or Downconverter [Diff]) being used.

- **LNB LO Frequency** – Enter the known LNB Rx LO (Low Oscillator) Frequency in MHz.

  Please consult the LNB adjunct product datasheet or its Installation and Operation Manual for the LO Frequency.

- **Rx L-Band Frequency** (950 to 2150 MHz for L-Band, 50 to 180 MHz for IF) – Enter the L-Band or IF-Band frequency in MHz, and then click **[Submit]**.

6.4.4.5.2.1.2 Configuration | WAN | Demod | ACM (Adaptive Coding and Modulation)

VersaFEC ACM requires Version 1.3.2 (or higher) firmware, and the appropriate FAST code for the maximum operating symbol rate.

Use this page to configure CDM-840 Rx ACM operations.

Outbound ACM allows you to configure a CTOG-250 Comtech Traffic Optimization Gateway to dynamically adjust the DVB-S2 MODCODs that are sent to each CDM-840 Remote Router, based on the conditions at that remote site. These conditions include antenna size, look angle and satellite band, as well as the current environmental conditions. Each CDM-840 will automatically and periodically send its Rx Es/No to the associated CTOG-250.

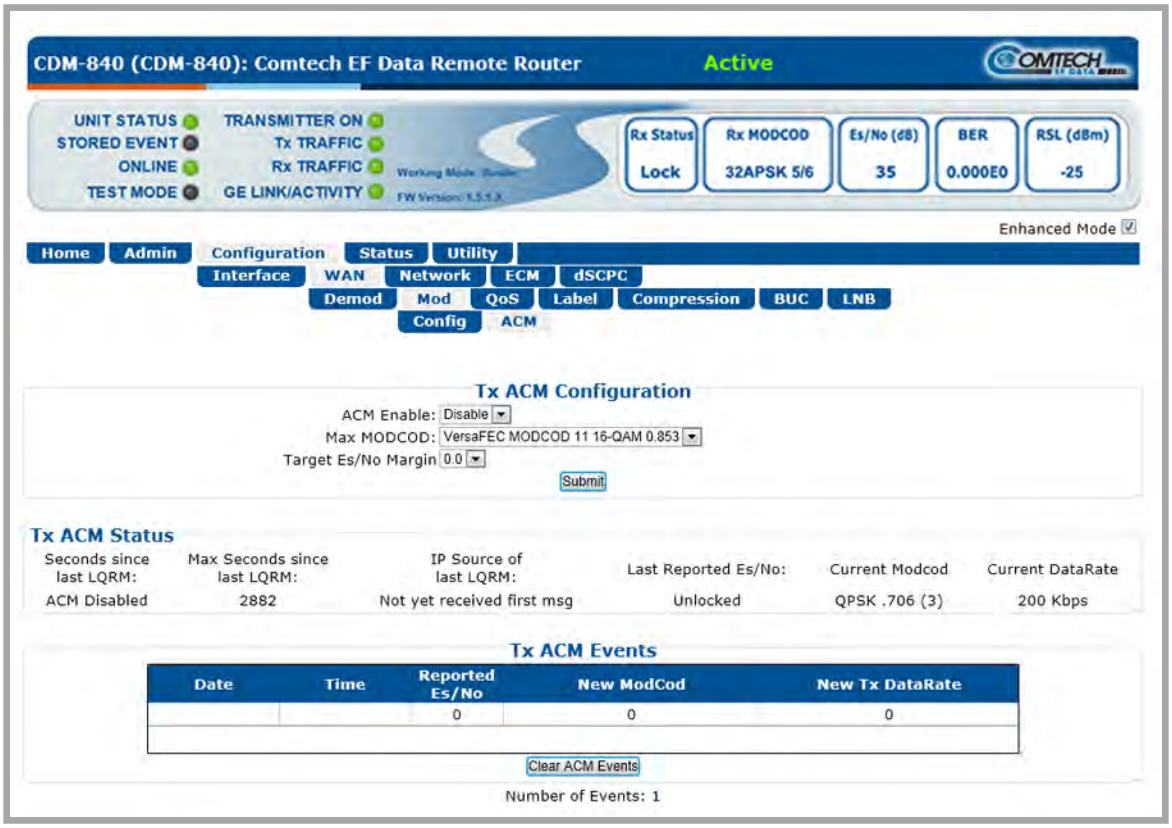


Figure 6-14. Configuration | WAN | Demod | ACM Page

Requirements for ACM operation are as follows:

- Outbound ACM must be enabled at the CTOG-250.
- When Outbound ACM is disabled at the CTOG-250, all packets will revert to the “VCM Only MODCOD” which is configured in each QoS Group.
- Each CDM-840 must be locked to the Shared Outbound carrier from the CTOG-250.

If an CDM-840 Remote Router reports that its demod is unlocked, the ACM Controller will assign the lowest MODCOD (QPSK ¼) to that remote in an effort to "recover" the remote. Once the remote locks again, the ACM algorithm adapts to the correct MODCOD for the reported Rx Es/No.

- A packet path is required from the CDM-840 to the CTOG-250 Management interface.

Rx ACM Configuration

- **Rx Max MODCOD –** Use the drop-down list to select the maximum demodulation type and FEC rate (MODCOD). The available selections are:

• QPSK 1/4	• QPSK 1/3	• QPSK 2/5	• QPSK ½
• QPSK 3/5	• QPSK 2/3	• QPSK 3/4	• QPSK 4/5
• QPSK 5/6	• 8PSK 3/5	• 8PSK 2/3	• 8PSK 3/4
• 16APSK 2/3	• 16APSK 3/4	• 16APSK 5/6	• 16APSK 9/10
• 32APSK 3/4	• 32APSK 4/5	• 32APSK 5/6	• 32APSK 9/10

- **Rx Target Es/No Margin** – Use the drop-down list to select a margin value, in 0.5 dB increments, from 0.0 to 4.5 dB.

The ACM system is designed to switch based on thresholds that correspond to a BER of 5 x 10^{-8} for each MODCOD. However, in order to prevent oscillation around two MODCODs at this exact value, 0.3 dB of hysteresis has been added.

Click **[Submit]** to save.

Rx ACM Status (read-only)

Information is presented in this section as follows:

- **Rx ACM Enable –** Identifies ACM operation as **Enabled** or **Disabled.**

- **Time Since Last Controller Announcement** – Amount of time in seconds since the the CDM-840 received an announcement message from the CTOG-250.

- **Max Time Since Last Controller Announcement** – Maximum amount of time since last announcement message was received from the CTOG-250.

- **ACM/VCM Controller IP Address** – The assigned IP Address for the Controller. This will be the management IP address for the associated CTOG-250.

6.4.4.5.2.2 Configuration | WAN | Mod (Modulator) Pages

Click the **Configuration | WAN | Mod** tabs, and then select the **Config** or **ACM** tab to continue.

6.4.4.5.2.2.1 Configuration | WAN | Mod | Config

Use this page to configure CDM-840 Tx modulator operations.

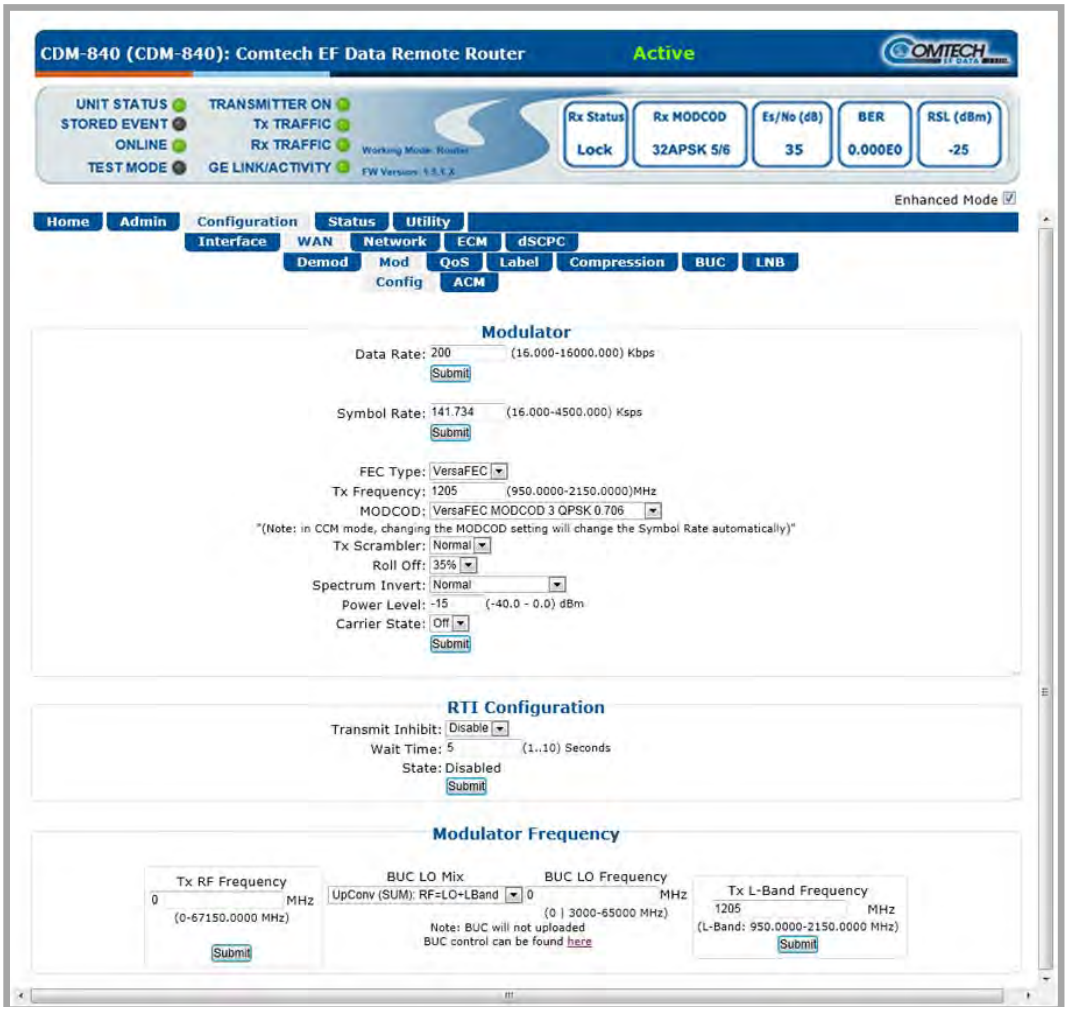
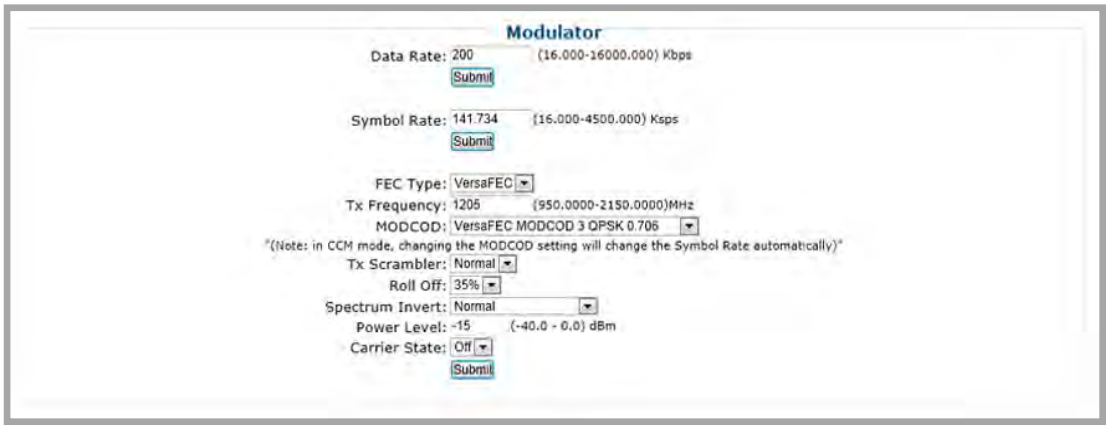


Figure 6-15. Configuration | WAN | Mod | Config Page

Modulator



The upper range of Data and Symbol Rate selection requires activation of the* TRANSMIT DATA RATE *FAST option.

The acceptable/valid operating range for each item in this section is provided in parentheses.

- **Data Rate** (16 to 15343 kbps) – Enter The CDM-840 Tx Data Rate in **kbps**. Click **[Submit]** to save.

  When Adaptive Coding and Modulation (ACM) is set to Enable, the Data Rate is set automatically (manual configuration of Data Rate is disabled), and the appearance of the Data Rate section changes as follows:

- **Symbol Rate** (16 to 4500) – Enter The CDM-840 Tx Symbol Rate in **ksps**. Click **[Submit]** to save.

- **FEC Type** – At present, **VersaFEC** is the sole available FEC type.

- **Tx Frequency** (950 to 2150 MHz) – Enter The CDM-840 Tx frequency in MHz.

- **MODCOD** (applicable only to CCM Mode) – Use the drop-down list to select the Modulation type and FEC rate (MODCOD). The available selections are:

  - VersaFEC MODCOD 0 – BPSK 0.488
  - VersaFEC MODCOD 1 – QPSK 0.533
  - VersaFEC MODCOD 2 – QPSK 0.631
  - VersaFEC MODCOD 3 – QPSK 0.706
  - VersaFEC MODCOD 4 – QPSK 0.803
  - VersaFEC MODCOD 5 – 8-QAM 0.642
  - VersaFEC MODCOD 6 – 8-QAM 0.711
  - VersaFEC MODCOD 7 – 8-QAM 0.780
  - VersaFEC MODCOD 8 – 16-QAM 0.731
  - VersaFEC MODCOD 9 – 16-QAM 0.780
  - VersaFEC MODCOD 10 – 16-QAM 0.829
  - VersaFEC MODCOD 11 – 16-QAM 0.853

- **Tx Scrambler** – Use the drop-down list to select the Tx Scrambler as **Off** or **Normal**.

- **Roll Off** – The Tx Alpha Rolloff **(α)** dictates how fast the spectral edges of the carrier are attenuated beyond the 3 dB bandwidth. With 20% rolloff the edge falls off more quickly than with 25% and 35%.

  Use the drop-down list to set the expected filter Tx Alpha Rolloff **(α)** of the carrier as **20%**, **25%**, or **35%**. The default selection is **20%**.

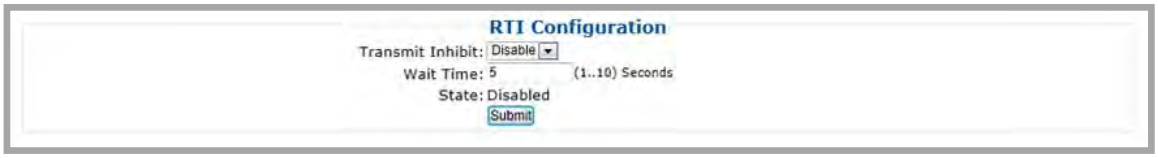
- **Spectrum Invert** – Use the drop-down list to select the Tx Spectrum Invert as **Normal** or **Tx Spectrum Inverted.**

- **Power Level** (-40 to 0) – Enter the Tx power level in **dBm**.

- **Carrier State** – Use the drop-down list to select the Tx Carrier State as **Off** or **On**.

  Select or enter the desired FEC Type, Tx Frequency, MODCOD, Tx Scrambler, Spectrum Invert, and Carrier State settings. Click **[Submit]** to save.

RTI Configuration



RTI means RECEIVE/TRANSMIT INHIBIT. When selected, it will prevent the Tx carrier from being transmitted until the demodulator is locked. To avoid the Tx Carrier from being turned off when the demodulator loses lock for a very short period of time, the demodulator must be unlocked continuously for the selected time period (1 to 5 seconds) before the transmit carrier is inhibited.

- **Transmit Inhibit** – Use the drop-down list to **Disable** or **Enable** RTI operation.

- **Wait Time** – Enter a time, in seconds, to delay execution of the RTI function (when Enabled). The range is from **1** to **5** seconds.

- **State** (*read-only*) – The operational status of the RTI function is displayed here.

Click **[Submit]** to save.

Modulator Frequency

The Tx Frequency Calculator provided here conveniently allows you to start from either the Tx RF or Tx L-Band/IF Frequency and calculate the "other" frequency. If the BUC LO Mix, BUC LO Frequency, and one of the desired frequencies are known, then the other can be calculated.

This calculator is intended to remove any guess work associated with the modem's L-Band/IF Frequency to the terminal's RF frequency (or vice versa).

The acceptable/valid operating range for each item in this section is provided in parentheses.

- **Tx RF Frequency** (0 to 67150) – This is the frequency at which the terminal is transmitting to the satellite. Upon configuring this to a non-zero value, as well as entering in the BUC LO Mix and Frequency, the modem's L-Band or IF frequency will be automatically configured.

  Enter the Tx RF Frequency in MHz. Click **[Submit]**. Upon submission, if the BUC LO Frequency has been entered, the resulting Tx RF Frequency will be displayed.

  If the BUC LO Frequency is left at the default configuration of zero, the Tx RF Frequency will not be calculated.

  The BUC LO Mix and BUC LO Frequency entries are provided for calculation purposes only. BUC configuration is not updated as a result of configuring these parameters.

- **BUC LO Mix** – Use this drop-down list to select the BUC LO (Low Oscillator) Mix as **Upconv (SUM): RF=LO+LBand** or **DownConv (Diff): RF=LO-LBand**.

  Consult your BUC adjunct product datasheet or its Installation and Operation Manual for the type of BUC (Upconverter [Sum] or Downconverter [Diff]) being used.

- **BUC LO Frequency** – Enter the known BUC Tx LO (Low Oscillator) Frequency in MHz.

  Consult your BUC adjunct product datasheet or its Installation and Operation Manual for the LO Frequency.

- **Tx L-Band Frequency** (950 to 2150 MHz for L-Band, 50 to 180 MHz for IF) – Enter the L-Band or IF-Band frequency in MHz. Click **[Submit]**.

6.4.4.5.2.2.2 Configuration | WAN | Mod | ACM

VersaFEC ACM requires Version 1.3.2 (or higher) firmware, and the appropriate FAST code for the maximum operating symbol rate.

Use this page to configure CDM-840 Tx ACM operations.

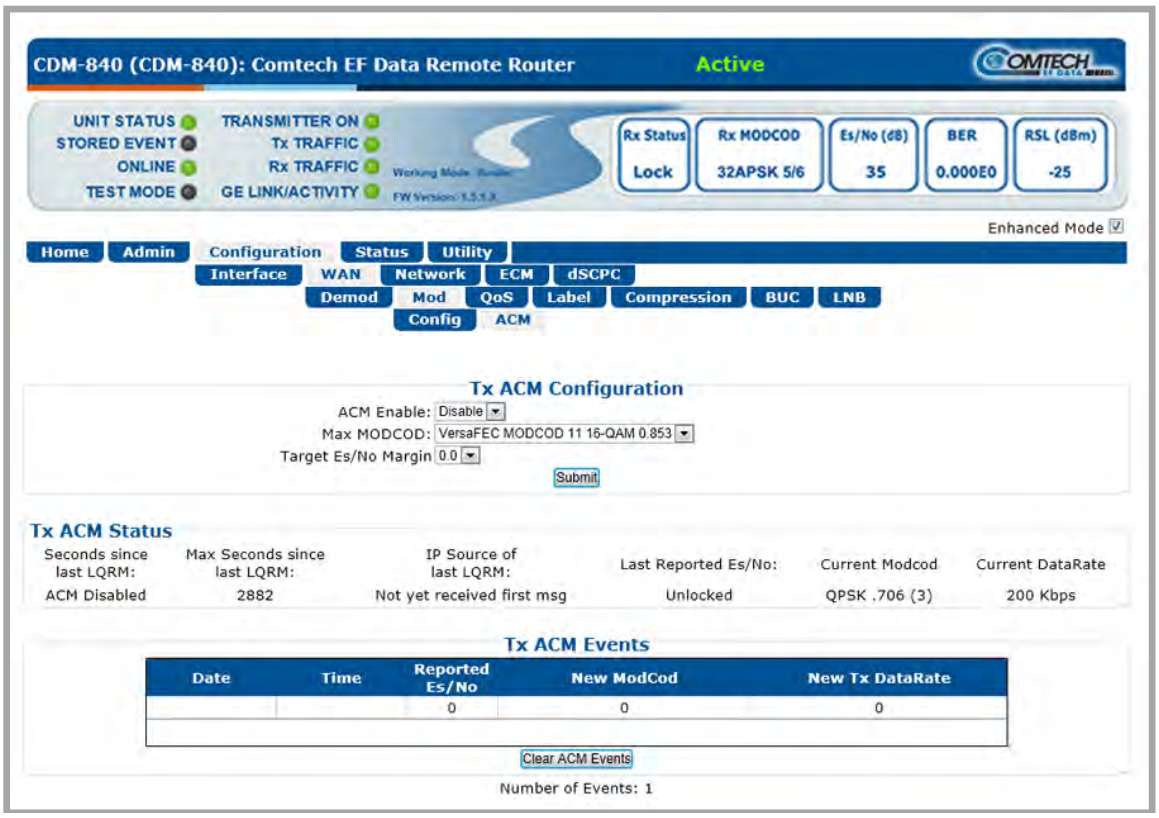


Figure 6-16. Configuration | Mod | ACM Page

Tx ACM Configuration

- **ACM Enable** – Use the drop-down list to **Disable** or **Enable** Tx ACM operation.

  With ACM set to* Enable*, the* Configuration | Mod | Config *page updates to disable manual configuration of the Max MODCOD (Data Rate) parameter.

- **Max MODCOD** – Use the drop-down list to select the maximum Modulation type and FEC rate (MODCOD). The available selections are:
  - VersaFEC MODCOD 0 – BPSK 0.488
  - VersaFEC MODCOD 1 – QPSK 0.533
  - VersaFEC MODCOD 2 – QPSK 0.631
  - VersaFEC MODCOD 3 – QPSK 0.706
  - VersaFEC MODCOD 6 – 8-QAM 0.711
  - VersaFEC MODCOD 7 – 8-QAM 0.780
  - VersaFEC MODCOD 8 – 16-QAM 0.731
  - VersaFEC MODCOD 9 – 16-QAM 0.780

- VersaFEC MODCOD 4 – QPSK 0.803
- VersaFEC MODCOD 5 – 8-QAM 0.642
- VersaFEC MODCOD 10 – 16-QAM 0.829
- VersaFEC MODCOD 11 – 16-QAM 0.853

- **Target Es/No Margin** (0.0 to 4.5) – Use the drop-down list to select a margin value, in 0.5 dB increments.

The ACM system is designed to switch based on thresholds that correspond to a BER of 5 x 10^{-8} for each MODCOD. However, in order to prevent oscillation around two MODCODs at this exact value, 0.3 dB of hysteresis has been added.

Click **[Submit]** to save.

Tx ACM Status (read-only)

From left to right:

Column	Description
Seconds since last LQRM	Amount of time (in seconds) since an LQRM (Link Quality Report Message) message was received from the associated CDD-880 Multi Receiver Router.
Max Seconds since last LQRM	Maximum amount of time since the last LQRM message was received.
IP Source of last LQRM	The source IP Address from where the last LQRM message was received.
Last Reported Es/No	EsNo value received in the last LQRM message.
Current MODCOD	Currently selected MODCOD.
Current DataRate	Current data rate based on current symbol rate and MODCOD.

Tx ACM Events (read-only)

In addition to the date- and time-stamp assigned for each event, information is presented in this section as follows *(from left to right)*:

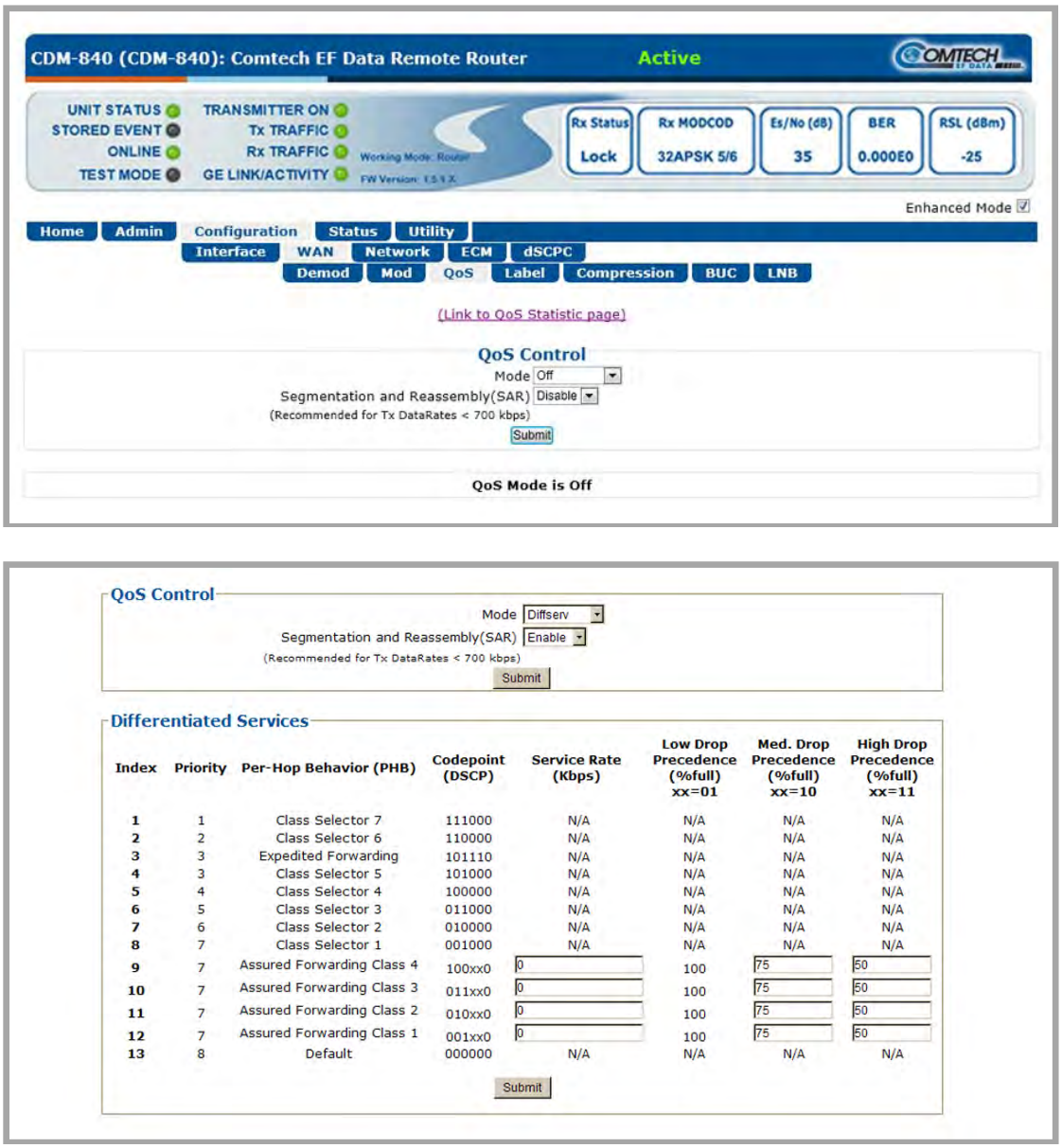
Column	Description
Reported ES/No	EsNo value.
New MODCOD	Newly selected MODCOD.
New Tx DataRate	New data rate based on new MODCOD and current symbol rate.

Click **[Clear ACM Events]** to clear all ACM statistics from the buffer.

6.4.4.5.2.3 Configuration | WAN | QoS

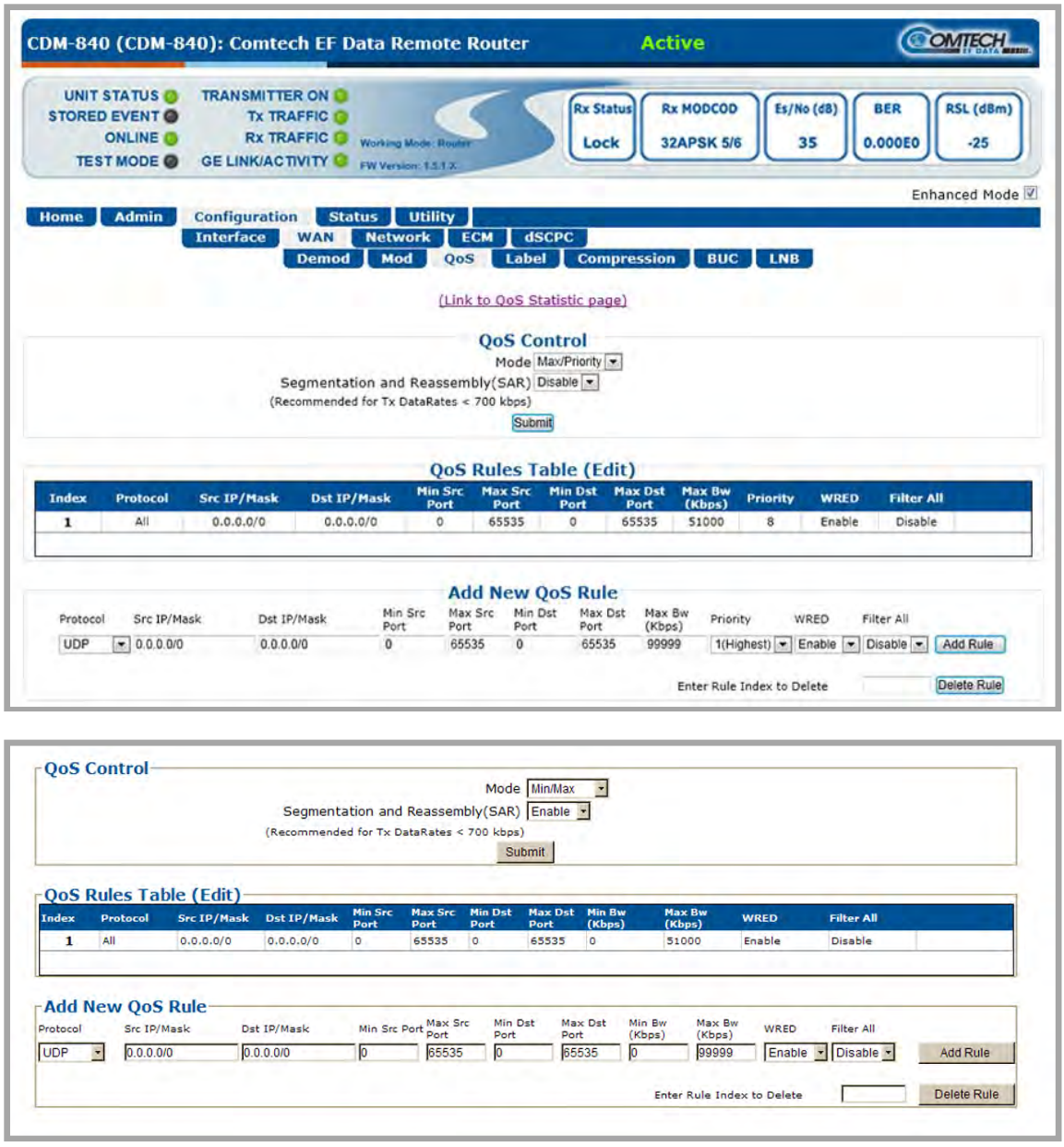
The* ADVANCED QUALITY OF SERVICE *FAST feature, once activated, is available only when the standard QoS feature is enabled.

The appearance of this page changes depending on the selected QoS Control Mode.



(TOP) QoS Control Mode = OFF
(BOTTOM) QoS Control Mode = Diffserv (Banner, VFP, Menu Bar not shown)

Figure 6-17. Configuration | WAN | QoS Page



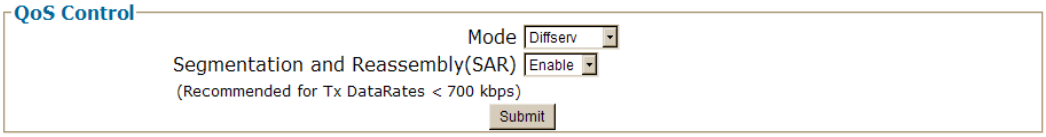
(TOP) QoS Control Mode = Max/Pri
(BOTTOM) QoS Control Mode = Min/Max (Banner, VFP, Menu Bar not shown)

Figure 6-18. Configuration | WAN | QoS Page (cont.)

Click the **(Link to QoS Statistic page)** hyperlink to access the **Status | Statistics | QoS** page (**Sect. 6.4.4.5.2.3**).

QoS Control

The QoS Control section is typical for <u>all</u> active QoS configurations.



- **Mode** – Use the drop-down list to select the mode of QoS operation:

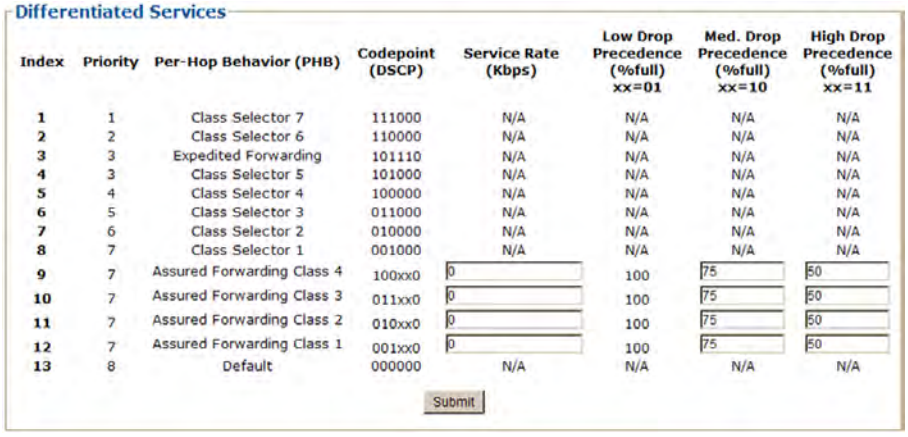
Mode	Description
Off	This mode disables QoS. Instead of an operable page, the Configuration | WAN | QoS page appears as shown at top in Figure 6-17.
DiffServ	This mode allows the CDM-840 to operate in Differentiated Services (DiffServ) Mode to make it fully compliant to the Differentiated Services QoS RFC (Request For Comments) standards. The Configuration | WAN | QoS page appears as shown at bottom in Figure 6-17.
Max/Pri	This mode provides multi-level traffic prioritization with the ability to define a prioroity and a maximum traffic per user-defined class/rule. The Configuration | WAN | QoS page appears as shown at top in Figure 6-18.
Min/Max	This mode provides a Committed Information Rate (CIR) to each user-defined class of traffic with the ability to allow a higher burstable rate depending on availability. The Configuration | WAN | QoS page appears as shown at bottom in Figure 6-18.

- **Segmentation and Reassembly (SAR)** – SAR is an adaptive process recommended for Tx Data Rates < 700 kbps. At lower data rates, it improves the jitter and latency performance for high priority packets. Use the drop-down list to **Disable** or **Enable** SAR.

Set the desired configurations. Click **[Submit]** to save.

Differentiated Services (Diffserv)

The Differentiated Services table appears only when QoS Control Mode = DiffServ.



From left to right:

Column	Description
Index	The automatically-assigned specific rule internal index number is identified here.
Priority	IP traffic is prioritized based on the DSCP (DiffServ Code Points) Class Selector Precedence.
Per-Hop Behavior (PHB)	This is the Traffic class that determines how packets will be forwarded.
Codepoint (DSCP)	This is the Code Point value for the Type of Service (ToS) byte in the IP header.

The option is provided to configure each queue to one of the following attributes. *The acceptable/valid operating ranges are provided in this section in parentheses, where applicable. From left to right:*

Column	Description
Service Rate (Kbps)	(0.000/(Tx Data Rate)) The minimum bandwidth will be served first among the Assured Forwarding (ASFD) classes in case of bandwidth availability once Class Selector 7 through Class Selected 1 have been serviced.
Drop Precedence	ASFD Class 4 through 1 Code Points (b100xx0, b011xx0, b010xx0, and b001xx0) carry the drop precedence value (xx). In case of network congestion, a Weighted Random Early Detection (WRED) congestion avoidance algorithm is imposed on these queues to drop the packets randomly rather than 'tail drop.'
Low Drop Precedence (% full)	(0 to 100) In case of congestion, the WRED is applied after the queue depth exceeds the configured percentage value assigned for the Drop Precedence value b001.
Med. Drop Precedence (% full)	(0 to 99) In case of congestion, the WRED is applied after the queue depth exceeds the configured percentage value assigned for the Drop Precedence value b001.
High Drop Precedence (% full)	(0 to 99) In case of congestion, the WRED is applied after the queue depth exceeds the configured percentage value assigned for the Drop Precedence value b011.

Set the desired configurations. Click **[Submit]** to save.

The* QoS Rules Table (Edit) *and* Add New QoS Rule / Delete Rule *sections appear only when QoS Control Mode = Max/Pri or Min/Max.

QoS Rules Table (Edit)

When QoS Control is set to Max/Pri mode:

QoS Rules Table (Edit)

Index	Protocol	Src IP/Mask	Dst IP/Mask	Min Src Port	Max Src Port	Min Dst Port	Max Dst Port	Max Bw (Kbps)	Priority	WRED	Filter All
1	All	0.0.0.0/0	0.0.0.0/0	0	65535	0	65535	51000	8	Enable	Disable

When QoS Control is set to Min/Max mode:

QoS Rules Table (Edit)

Index	Protocol	Src IP/Mask	Dst IP/Mask	Min Src Port	Max Src Port	Min Dst Port	Max Dst Port	Min Bw (Kbps)	Max Bw (Kbps)	WRED	Filter All
1	All	0.0.0.0/0	0.0.0.0/0	0	65535	0	65535	0	51000	Enable	Disable

From left to right:

Column	Description
Index	The automatically-assigned specific rule internal index number is identified here.
Protocol	The protocol for the specific rule is identified here.
• Src IP Mask • Dst IP Mask	The Source and Destination IP Addresses/Masks are displayed in these columns.
• Min Src Port • Max Src Port • Min Dst Port • Max Dst Port	The Source and Destination Ports are displayed in these columns.
• Min BW (Kbps) *(Min/Max mode only)* • Max BW (Kbps)	The bandwidth values are displayed in these columns.
Priority *(Max/Pri mode only)*	The priority established for the specific rule is identified here.
WRED	The W RED (Weighted R andom E arly D etection) s etting f or t he s pecific r ule i s identified here as Disable or Enable. When WRED is enabled, the QoS Queue will attempt t o s moothly dr op pa ckets as t he queue get s c ongested. T his i s recommended for queues that will carry TCP packets.
Filter All	The flow filter setting for the specific rule is identified here as Disable or Enable.

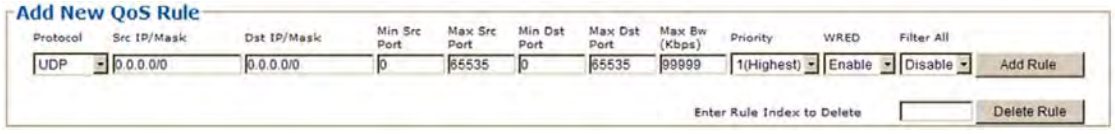
Add New QoS Rule / Delete Rule

Refer to the **QoS Rules Table (Edit)** section for the description of each column.

- ***To delete an existing rule:*** For either page, **Enter Rule Index to Delete**. Click **[Delete Rule]** when done. This deletes the specified entry from the **QoS Rules Per Group Table**.

- ***To add a new rule:*** For either page, enter or select the desired information. Click **[Add Rule]** when done. The index will automatically increment to the next available number when the new rule is added.

- ***When QoS Control is set to Max/Pri mode:***

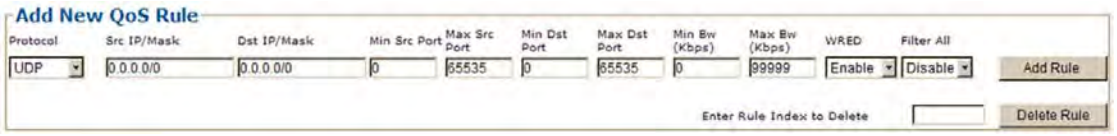


From left to right:

Column	Description
Priority	Use the drop-down list to designate a pr iority for this rule from 1 (Highest) to 8 (Lowest). The QoS system allows multiple QoS rules to have the same priority. When QoS rules are designated with the same priority, they are serviced on a time-sharing "round-robin" (time-sharing) basis.

Column	Description
WRED	Use the drop-down list to Enable or Disable Weighted Random Early Detection. When WRED is enabled, the QoS Queue will attempt to smoothly drop packets as the queue gets congested. This is recommended for queues that will carry TCP packets.
Filter All	Use the drop-down list to Disable or Enable the flow filter setting. If *enabled*, all packets matching this QoS Rule will be dropped.

- ***When QoS Control is set to Min/Max mode:***



From left to right:

Column	Description
WRED	Use the drop-down list to Enable or Disable Weighted Random Early Detection. When WRED is enabled, the QoS Queue will attempt to smoothly drop packets as the queue gets congested. This is recommended for queues that will carry TCP packets.
Filter All	Use the drop-down list to Disable or Enable the flow filter setting.

6.4.4.5.2.4 Configuration | WAN | Label

Use this page to assign up to four Generic Stream Encapsulation (GSE) labels.

Figure 6-19. Configuration | WAN | Label Page

Receive WAN Labels

Edit the **Label 1** through **Label 4** text boxes to suit. Each label has a valid range of 1 to 2047.

The assigned Receive WAN Labels must match the WAN Labels assigned on the CTOG-250 Route Table. Note that the preferred method of operation (as required for ACM/VCM Operation) is to configure a unique WAN Label in Entry #1 for each CDM-840 across the networ,k and then enable CDRP on the CTOG-250. The associated Route to WAN Label will be automatically updated and maintained.

Create the desired labels. Click **[Submit]** to save.

6.4.4.5.2.5 Configuration | WAN | Compression

Use this page to configure the Payload and Header Compression feature, if enabled.

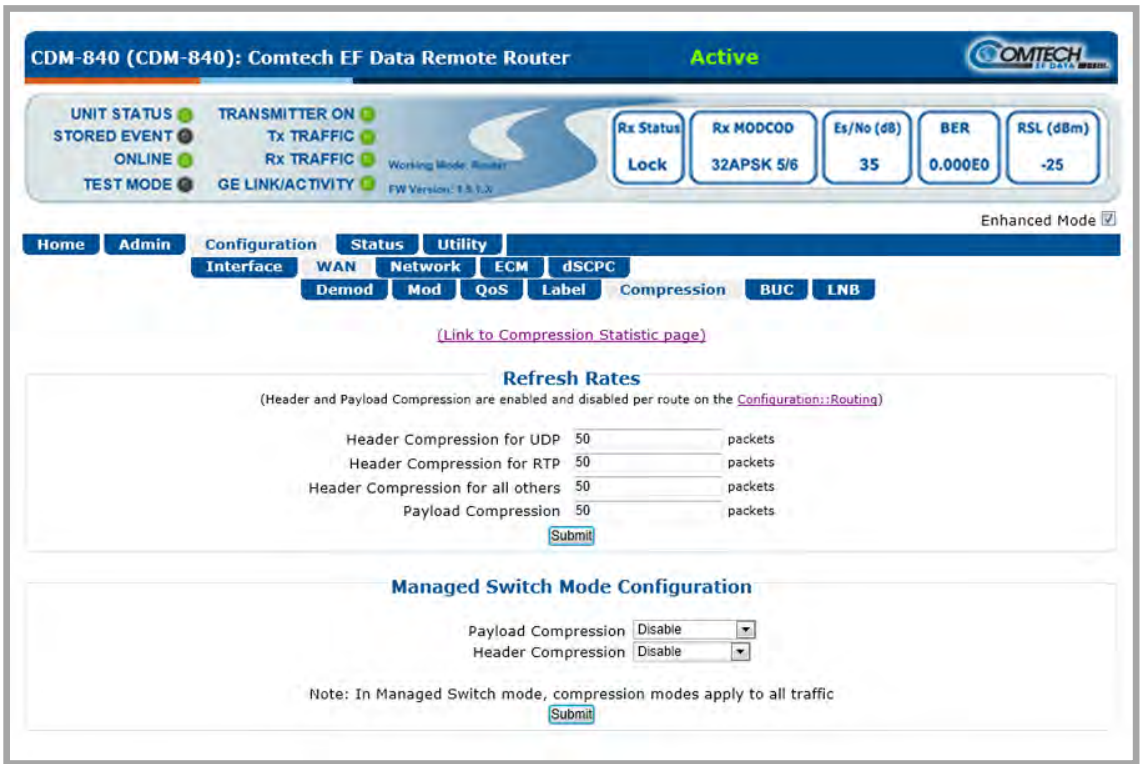


Figure 6-20. Configuration | WAN | Compression Page

Click the **(Link to Compression Statistic page)** hyperlink to access the **Status | Statistics | Compression** page (**Sect. 6.4.4.6.1.3**).

Refresh Rates

Enter each refresh rate, from **1** to **600** packets or **1** second (whichever comes first). *From left to right:*

Feature	Description
Header Compression for UDP	User Datagram Protocol refresh rate
Header Compression for RTP	Real Time Protocol refresh rate
Header Compression for all others	Default protocol refresh rate
Payload Compression	Payload Compression refresh rate

Set the desired rates. Click [**Submit]** to save.

Managed Switch Mode Configuration (BPM Mode)

Use the drop-down lists to **Enable** or **Disable** Payload and Header Compression for all of the transmitted packets when operating in Bridge Point-to-Multipoint (BPM) Mode. Click **[Submit]** to save.

In Managed Switch Mode, the selected Compression modes apply to all traffic.

6.4.4.5.2.6 Configuration | WAN | BUC (Block Upconverter)

This page is operational only when an optional BLOCK UPCONVERTER is installed.

Use this page to configure Block Upconverter parameters, and to display the BUC status for L-Band operation.

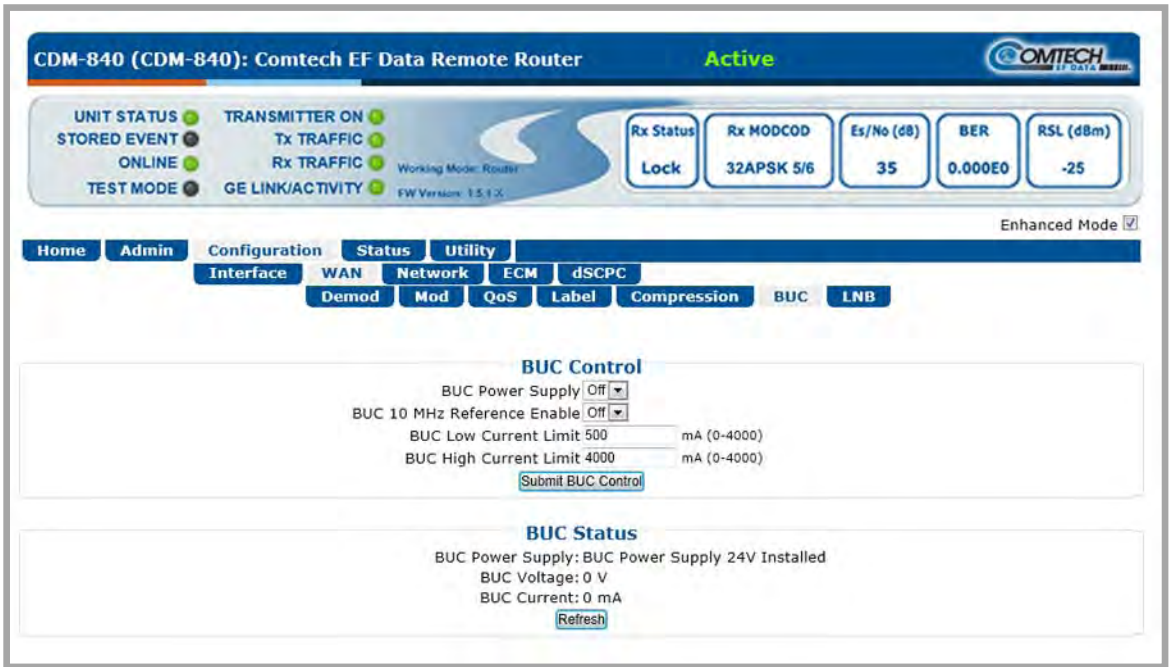


Figure 6-21. Configuration | WAN | BUC Page

BUC Control

The acceptable/valid operating range for each item in this section is provided in parentheses.

- **BUC Power Supply** – Use the drop-down list to select the BUC Power Supply as **Off** or **On**.
- **BUC 10 MHz Reference Enable** – Use the drop-down list to select the BUC 10 MHz Reference Enable as **Off** or **On**.

- **BUC Low or High Current Limit** (0 to 4000) – Enter the BUC current alarm for either limit in 100mA increments.

Set the desired BUC configurations. Click **[Submit BUC Control]** to save.

BUC Status

BUC Power Supply, **BUC Voltage (V)**, and **BUC Current (mA)** – When the presence of BUC Power Supply is detected, it is acknowledged here and its voltage and current information is continuously monitored and is provided on a ***read-only*** basis.

Click **[Refresh]** to update this section with its latest available statistics.

6.4.4.5.2.7 Configuration | WAN | LNB (Low Noise Block Downconverter)

This page is operational only when an optional LOW-NOISE BLOCK DOWNCONVERTER is installed.

Use this page to configure Low-Noise Block Downconverter parameters, and to display the LNB status for L-Band operation.

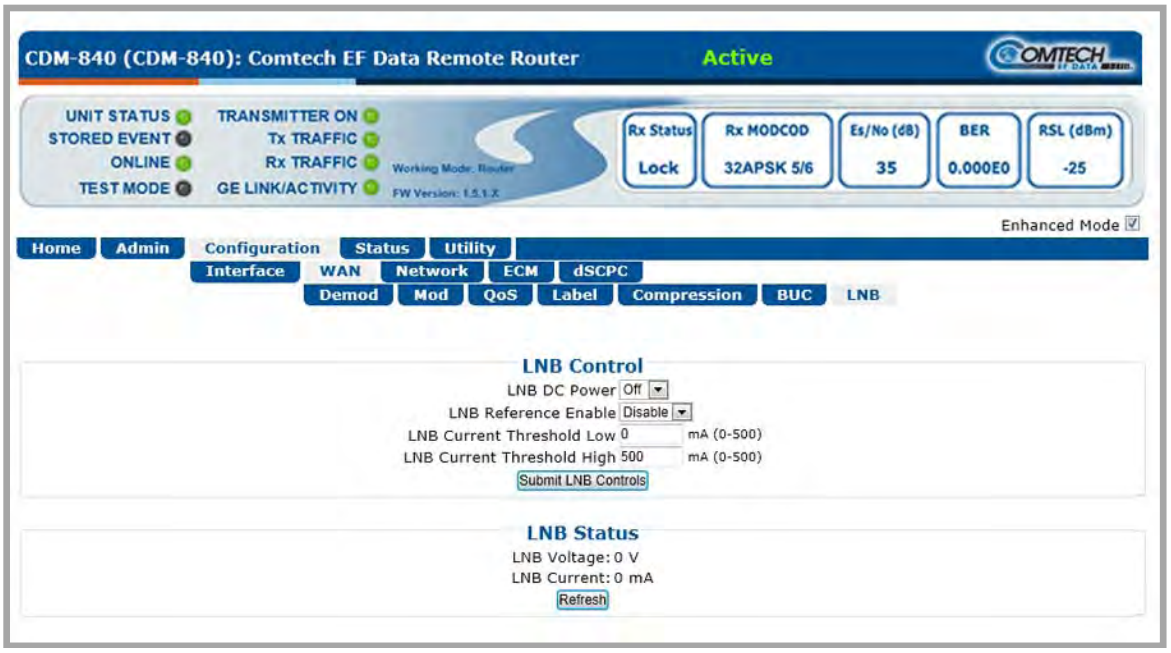


Figure 6-22. Configuration | WAN | LNB Page

LNB Control

The acceptable/valid operating range for each item in this section is provided in parentheses.

- **LNB DC Power** – Use the drop-down list to select the power as **Off**, **13V**, **18V**, or **24V**.

- **LNB Reference Enable** – Use the drop-down list to **Enable** or **Disable** the LNB Reference.
- **LNB Current Threshold (Low** and **High)** (0 to 500) – Enter a value, in mA, for either function.

Set the desired LNB configurations. Click **[Submit LNB Controls]** to save.

LNB Status

This ***read-only*** section provides the **LNB Current (mA)** and **LNB Voltage (V)** information.

Click **[Refresh]** to update this section with its latest available statistics.

6.4.4.5.3 Configuration | Network Pages

Precision Time Protocol is not available in this firmware release. The PTP tab, while available and selectable on this interface, is therefore non-functional.

Click the **Configuration | Network** tabs, and then select the **Routing**, **ARP**, **Working Mode**, or **DNS** tab to continue.

6.4.4.5.3.1 Configuration | Network | Routing Pages

Click the **Configuration | Routing** tabs, and then select the **Routes**, **IGMP**, or **DHCP** tab to continue.

6.4.4.5.3.1.1 Configuration | Network | Routing | Routes

Use this page to enter static routes for IP traffic over the satellite or to another device on the local LAN.

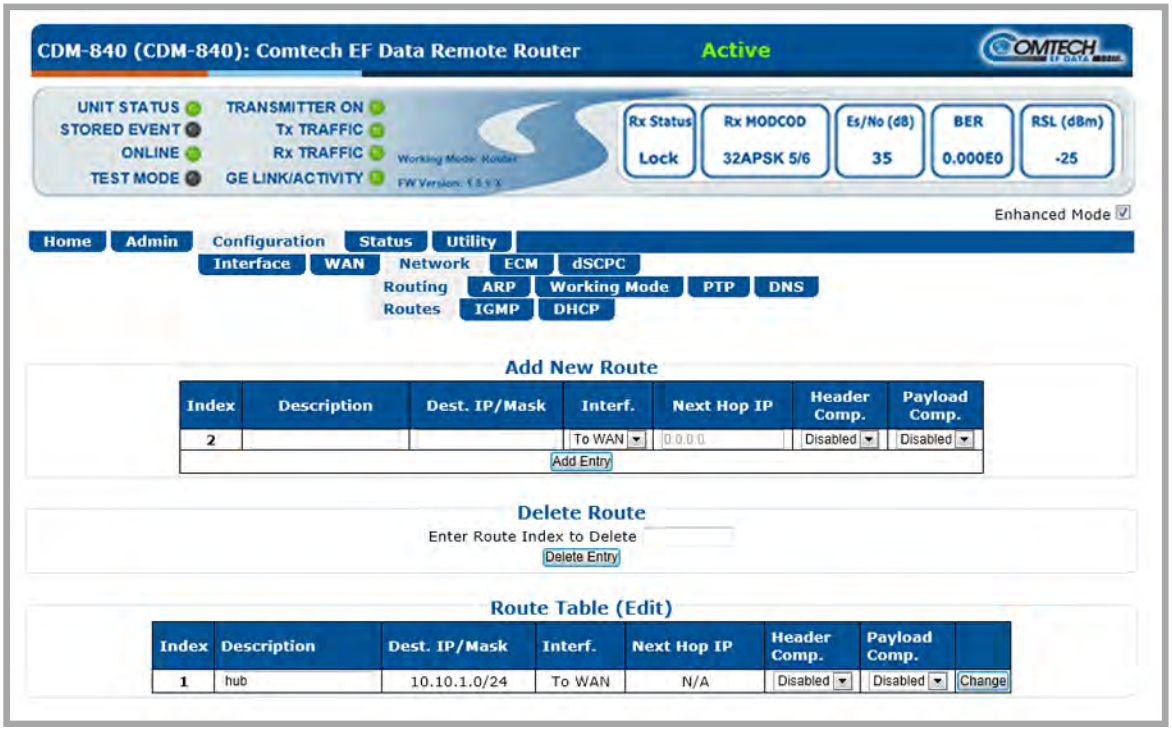


Figure 6-23. Configuration | Network | Routing | Routes Page

Add New Route

Use this section to directly add a Route Table entry. *From left to right:*

Column	Description
Index	This is the read-only internal table index. It cannot be edited.
Description	Enter a label string in this text box. This label helps to maintain the network. The assigned name must be unique and cannot contain any whitespace.
Dest. IP/Mask	Enter a Destination IP Address/Mask in the form XXX.XXX.XXX.XXX/YY.
Interf.	Use the drop-down list to select the Interface as toWAN or toLAN.
Next Hop IP	Enter the desired Next Hop IP Address for toLAN routes. Note that no Next Hop entry is needed for toWAN routes.
Header Comp.	Use the drop-down list to Disable or Enable Header Compression operation.
Payload Comp.	Use the drop-down list to Disable or Enable Payload Compression operation.

Enter the desired information. Click **[Add Entry]** when done. The index automatically increments to the next available number when the new route is added.

When in Router Mode, the CDM-840 will not transmit a multicast address in the Internet control range (224.0.0.0 to 224.0.1.255). It filters the packets.

Delete Route

Enter Route Index to Delete. This deletes the specified route entry from the route table. Click **[Delete Entry]** when done.

Route Table (Edit)

Use the text boxes and drop-down lists to edit all current Route Table entries, as described previously for the **Add New Route** section.

Click **[Submit Changes]** to save.

6.4.4.5.3.1.2 Configuration | Network | Routing | IGMP

IGMP (Internet Group Management Protocol), when enabled, responds to IGMP queries for the configured multicast routes on the transmit side and generates IGMP queries on the receive side. If there are no active IGMP receivers on the LAN, it stops forwarding the multicast traffic (received from the satellite) to the LAN.

Use this page to enable IGMP for configured multicast routes.

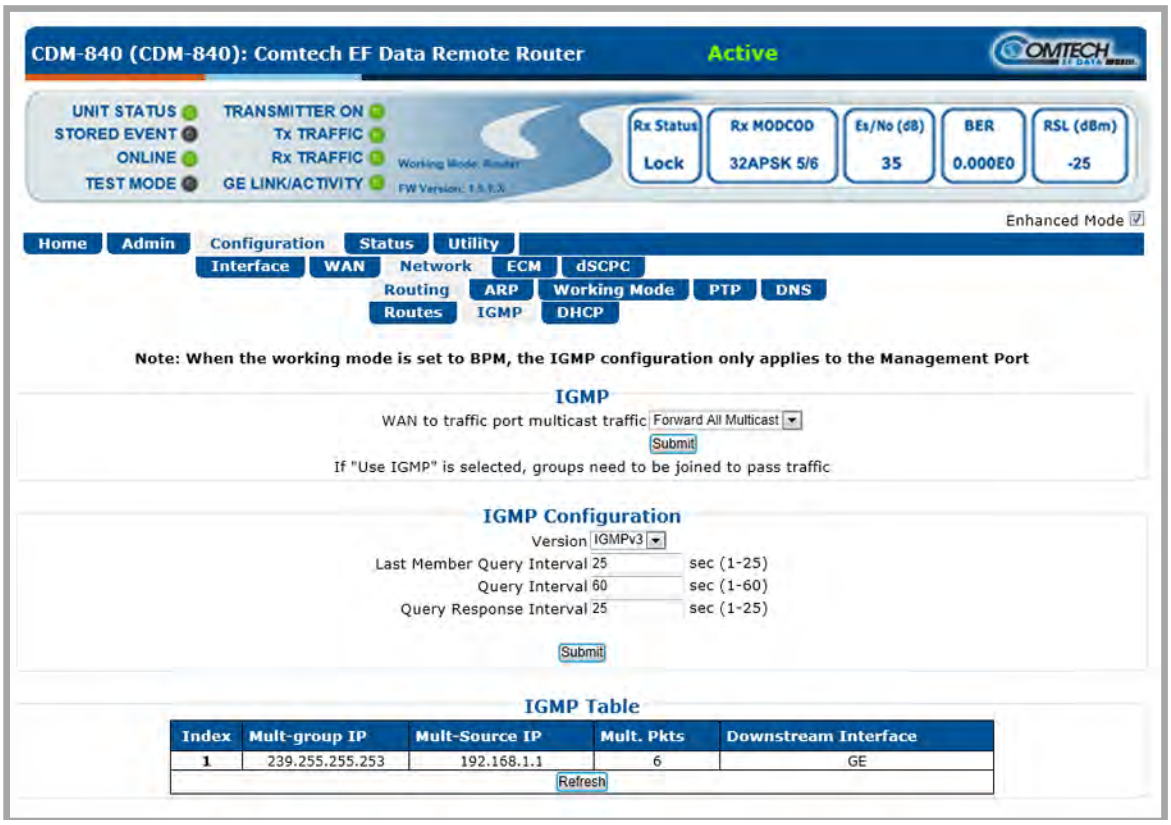


Figure 6-24. Configuration | Network | Routing | IGMP Page

IGMP

Use the drop-down list to select **IGMP** as **Enable.**

IGMP Configuration

The acceptable/valid operating ranges are provided in this section in parentheses, where applicable.

- **Version** – Use the drop-down list to select **IGMPv1**, **IGMPv2**, or **IGMPv3.**

- **Last Member Query Interval** (1 to 25) – This is the maximum response time inserted into group-specific queries that are set in response to Leave Group messages, and is also amount of time between group-specific query messages. This value may be tuned to modify the

"leave latency" of the network; a reduced value results in reduced time to detect the loss of the last member of a group.

Enter a value, in seconds. The default is **1** second.

- **Query Interval** (1 to 60) – This is the interval between general queries sent by the unit. By varying the query interval, the administrator may tune the number of IGMP messages on the subnet; note that larger numbers cause the IGMP queries to be sent less often.

  Enter a value, in seconds. The default is **1** second.

- **Query Response Interval** (1 to 25) –This is the maximum response time inserted into the periodic general queries. By varying the Query Response Interval, the administrator may tune the "burstiness" of IGMP messages on the subnet; note that larger values make the traffic less "bursty" as host responses are spread out over a large interval.

  Enter a value, in seconds. The default is **10** seconds.

The number of seconds assigned to the* Query Response Interval *must be less than the* Query Interval*.

Click **[Submit]** to save.

IGMP Table

This ***read-only*** table lists the IGMP Groups that are active on the unit. This allows you to determine which services are being used and the minimum time before a service will be terminated.

Click **[Refresh]** to update this section with its latest available statistics.

6.4.4.5.3.1.3 Configuration | Network | Routing | DHCP

DHCP (Dynamic Host Configuration Protocol) allows a device to be configured automatically, eliminating the need for intervention by a network administrator, and provides a server located at the hub for keeping track of devices that have been connected to the network. This prevents two devices from accidentally being configured with the same IP Address.

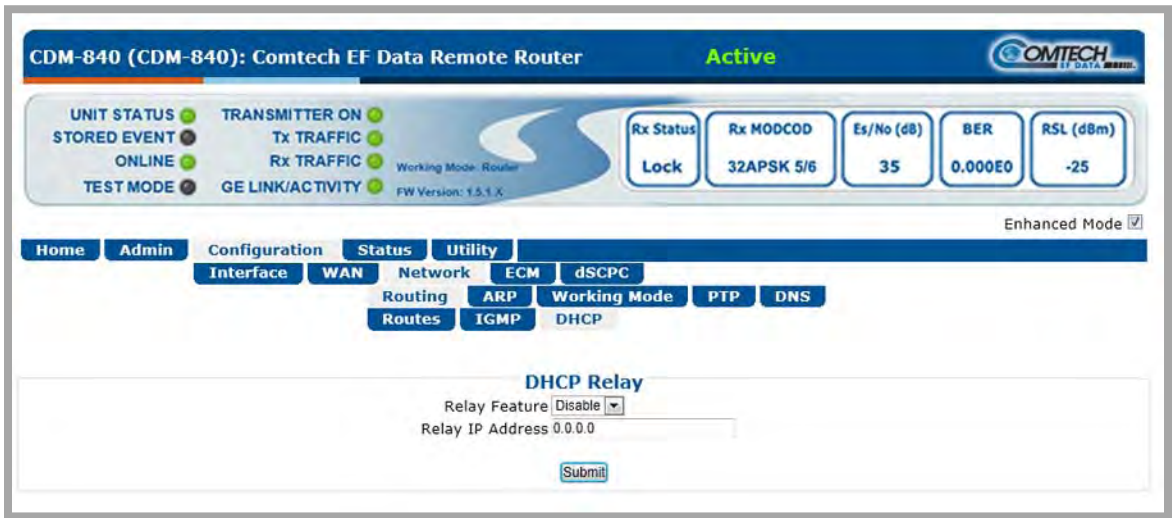


Figure 6-25. Configuration | Network | Routing | DHCP Page

DHCP Relay

The CDM-840 DHCP Relay feature allows the operator to deploy a single DHCP server at the hub that manages all of the devices throughout the operator's remote networks. When a device on the CDM-840 network issues a DHCP request, it is relayed to the DHCP server as specified by the "Relay IP Address". The DHCP response is then sent directly to the requesting device.

- **Relay Feature** – Use the drop-down list to select the DHCP Relay feature as **Enable** or **Disable**.

- **Relay IP Address** – Specify the IP Address to be used for the DHCP server at the hub in the form XXX.XXX.XXX.XXX.

Click **[Submit]** to save.

6.4.4.5.3.2 Configuration | Network | ARP

Use this page to configure CDM-840 ARP (Address Resolution Protocol) parameters.

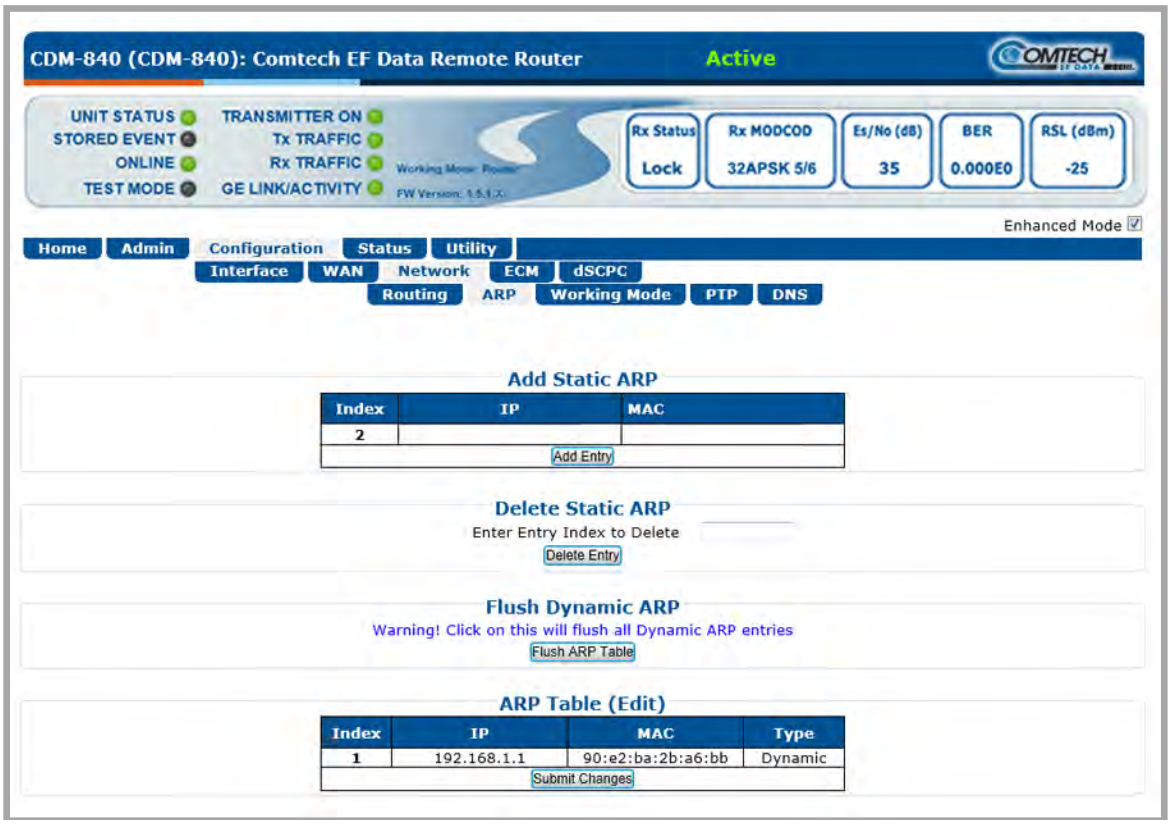


Figure 6-26. Configuration | Network | ARP Page

Add Static ARP

Enter the desired IP and MAC addresses. Click **[Add Entry]** when done. The **Index** column automatically increments to the next available number when the specified static ARP entry is added to the **ARP Table**.

Delete Static ARP

Enter Entry Index to Delete – This deletes the specified entry index from the **ARP Table**.

Click **[Delete Entry]** when done.

Flush Dynamic ARPs

Click **[Flush ARP Table]** – This deletes all dynamically-learned ARP entries.

ARP Table (Edit)

This section displays all current Static and Dynamic ARP entries, and allows to user to directly edit the current Static ARP entries. *From left to right:*

Column	Description
Index	This is the read-only internal table index. It cannot be edited.
IP	Entry IP Address, in the form XXX.XXX.XXX.XXX.
MAC	New data rate based on new MODCOD and current symbol rate.
Type	Entry Type is specified as Static or Dynamic and cannot be edited.

Make the desired IP and MAC Address edits. Click **[Submit Changes]** to save.

6.4.4.5.3.3 Configuration | Network | Working Mode

Appendix C. BRIDGE POINT-TO-MULTIPOINT (BPM) OPERATION

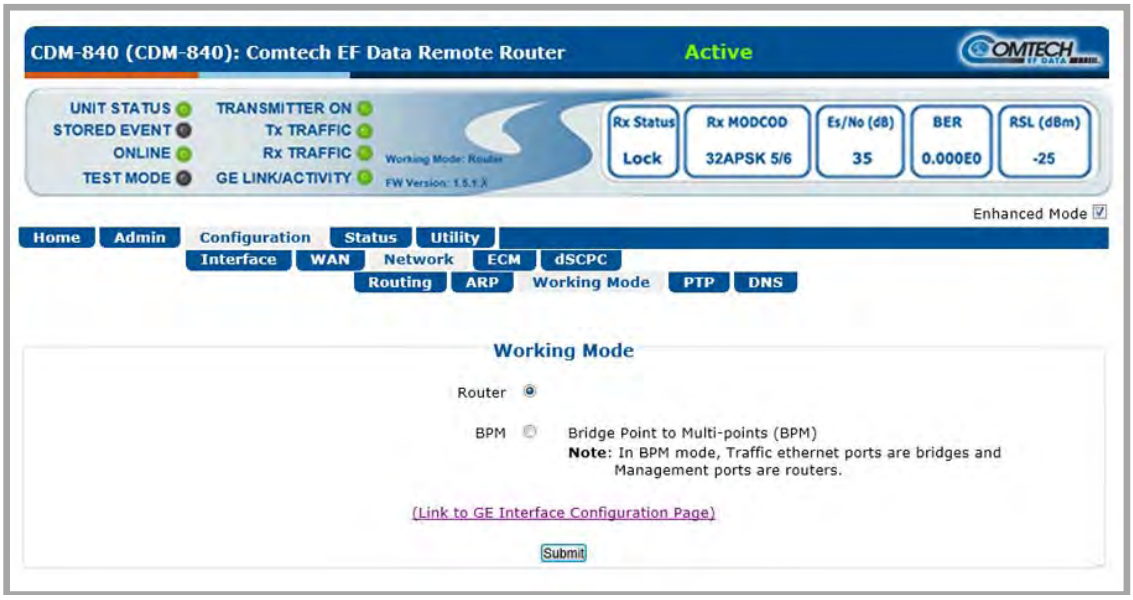


Figure 6-27. Configuration | Network | Working Mode Page

Working Mode

Select the desired working mode, and then click **[Submit]** to save:

- In **BPM** Mode, all L2/L3/L4 protocols such as VLAN, MPLS, IPv6, OSPF, and BGP will flow through the network as they would through an off-the-shelf Ethernet Switch. The Advanced VSAT BPM feature makes the Advanced VSAT equipment appear as a “Sky Ethernet Switch”. This will allow for a greatly simplified network deployment.

- In **Router** Mode, the traffic ports of the CDM-840, CTOG-250, and CDD-880 are configured to function as a Router.

6.4.4.5.3.4 Configuration | Network | DNS

Use this page to manage DNS (Domain Name System) caching. DNS caching speeds up Internet access by eliminating subsequent queries over the satellite link.

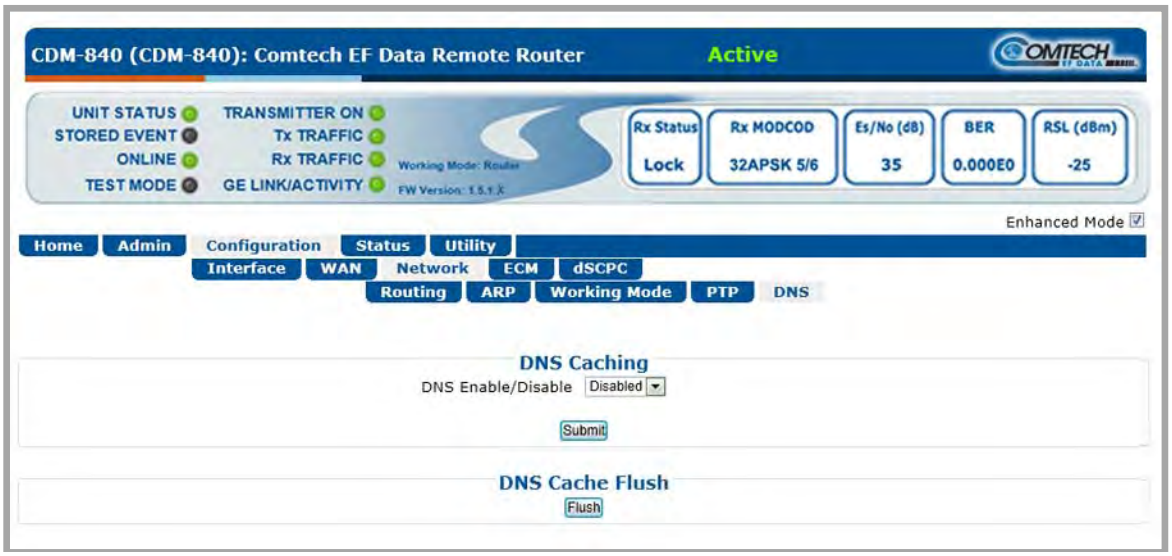


Figure 6-28. Configuration | Network | DNS Page

Note the following:

- When the CDM-840 receives a DNS query at one of its Ethernet Ports, a DNS cache look up is performed in the local DNS cache. If the entry is found, a DNS response message is immediately returned to the requesting entity with a time-to-live value of 10 seconds. If no match is found, the request packet is forwarded to the Hub.

- When a DNS response packet is received from Hub, a check is made to see if the entry already exists in the cache. If it exists, the time-to-live for the entry is reset to 900 seconds (15 minutes). If it's a new entry it is added to the cache with time-to-live set to 900 seconds (15 minutes).

- The local DNS cache is periodically cleaned by removing expired entries

DNS Caching

Use the drop-down list to set DNS as **Enabled** or **Disabled**. Click **[Submit]** to save.

DNS Cache Flush

Click **[Flush]** to clear the DNS Cache of all data.

6.4.4.5.4 Configuration | ECM (Entry Channel Mode)

This page is operational only when the optional dSCPC FAST feature and VIPERSAT MANAGEMENT SYSTEM (VMS) is installed and enabled.

- **Appendix F. ENTRY CHANNEL MODE (ECM) in this manual**
- **Appendix G. ENTRY CHANNEL MODE SWITCHING *in the adjunct CEFD publication* VMS v3.x.x VIPERSAT Management System User Guide (CEFD P/N MN/22156)**

ECM (Entry Channel Mode) provides a method for remotes requiring dSCPC access channels to either enter the network initially or re-enter the network after a power or service outage. Use this page to configure ECM.

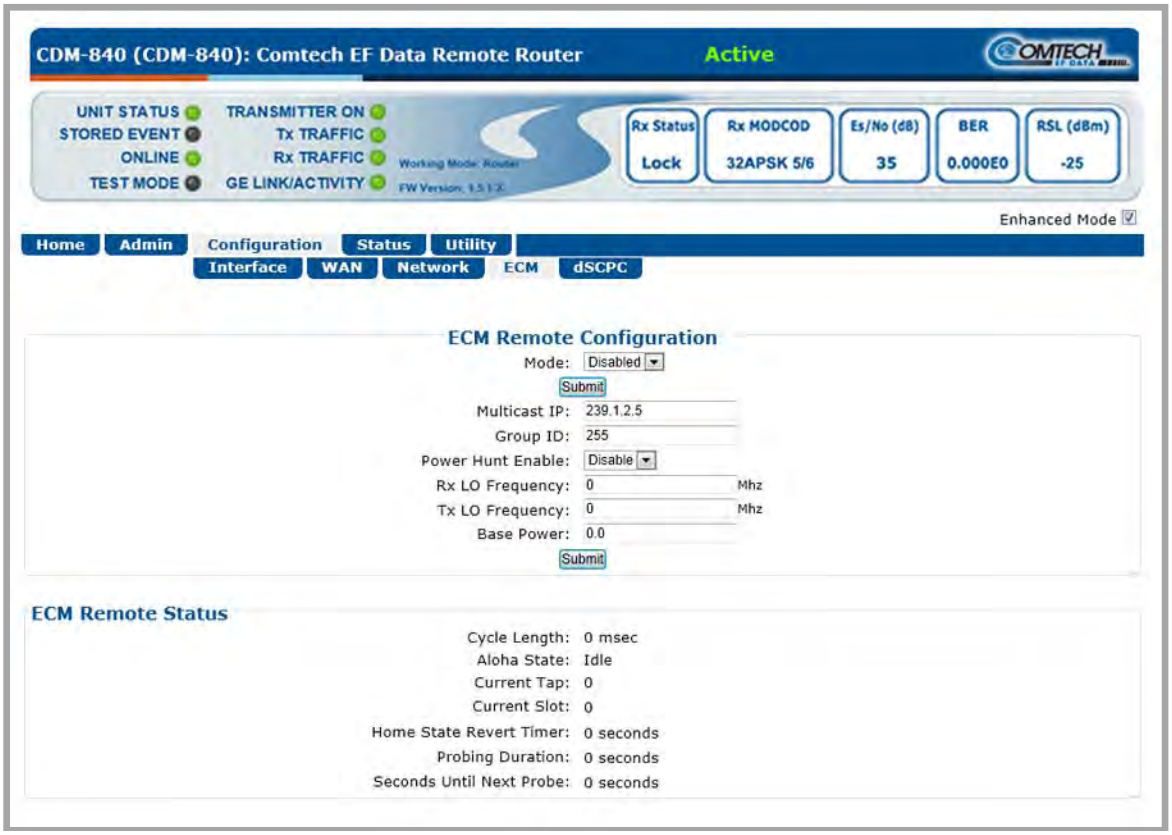


Figure 6-29. Configuration | ECM Page

ECM Remote Configuration

The acceptable/valid operating ranges for items in this section are provided in parentheses.

- **Mode** – Use the drop-down list to select operation as **Disabled**, **Offline**, **Wait**, or **Online**:

Selection	Description
Disabled	This *disables* ECM operation.
Offline	The remote will not transmit and remains in this standby mode until a new state is selected, either locally or from the VMS. Application examples for this mode include COTM (communications on the move) or military maneuvers requiring radio silence conditions.
Wait	Keeping CDM-840(s) in the ECM channel may result in oversubscription, where some percentage of remotes wait their turn for pooled SCPC resources. The user may choose to selectively control remotes through manual, scheduled, or external switch request commands. By selecting **Wait**, the CDM-840(s) remain in standby mode, but continue to send status messages to the VMS and CTOG-250 Comtech Traffic Optimization Gateway (w/integrated CDM-800 Gateway Router). In Wait mode, messages directed to the VMS update connected link status, while ACM, CDRP, and traffic data statistics sent to the CTOG-250 maintain forward path ACM and routing tables (if in dynamic routing mode).
Online	The CDM-840 powers up, requests network registration, and switches to dSCPC at its minimum site policy data rate setting. ***This is the most common mode of operation.***

Click **[Submit]** to save.

- **Multicast IP** – Enter the IP address for the Multicast of the Transmission Announcement Protocol (TAP) message that is sent out by the CDD-880 Multi Receiver Router to all of the associated CDM-840 or CDM-840 Remote Routers in that group.

- **Group ID** (0 to 255) – Enter the Group ID number for the CDD-880 to which this unit belongs.

- **Power Hunt Enable** – Use the drop-down list to select this function as **Disable** or **Enable**. When enabled, the transmission power control feature for the unit modulator is activated while in Entry Channel Mode (ECM). This function provides compensation during periods of impaired transmission or for instances when the initial (baseline) power value is insufficient, and assists in maintaining return link integrity.

- **Rx LO Frequency** – Assign a value, in MHz, to the Rx LO (Low Oscillator) Frequency.

- **Tx LO Frequency** – Assign a value, in MHz, to the Tx LO (Low Oscillator) Frequency.

- **Base Power** (–40.0 to 0.0) – Enter the power level, in dBm, for transmission of the Aloha ECM signal. This level was determined for this unit when its terminal was commissioned, and must be calibrated with the satellite provider.

Click **[Submit]** to save.

ECM Remote Status (read-only)

- **Cycle Length** – The Cycle Length is the total length of time, in milliseconds, between the start of a transmission and the completion of the transmission cycle (TAP) transmitted by the CDD-880 to the CDM-840 or CDM-840 Remote Routers in the ECM group. It is the product of the number of slots and the slot length (consisting of the preamble, data slot size, and guard band).

- **Aloha State** – The Aloha State indicates the current state of this unit during the ECM cycle:

Unit State	Description
Idle	Unit is not transmitting; either inactive or waiting for switching assignment.
Active	Unit is actively transmitting (probing) to the Hub for either registration or request for switching to dSCPC.
Switched	Remote has successfully switched from ECM to dSCPC.

- **Current Tap** – Indicates current value of sequential progression of TAP message transmission. Ranges from 0 to 255, then repeats.

- **Current Slot** – The time slot number that has been assigned to this unit in the transmission cycle for switching from ECM to dSCPC.

- **Home State Revert Timer** – The time, in seconds, that must pass without receiving communications from the HCC (Hub Channel Controller – i.e., Demod #1 on the CDD-880, the designated ECM controller) TAP message before this unit is reverted from dSCPC mode back to ECM to re-establish communications settings for receiving the TAP. *This parameter is set in the VMS.*

- **Probing Duration** – Amount of time, in seconds, that this unit has been transmitting to the HCC to request registration and switchout.

- **Seconds Until Next Probe** – The time period, in seconds, before this unit will again transmit to the HCC.

6.4.4.5.5 Configuration | dSCPC (Dynamic Single Carrier per Channel)

This page is operational only when the optional dSCPC FAST feature and VIPERSAT MANAGEMENT SYSTEM (VMS) is installed and enabled.

Use the optional dSCPC (Dynamic Single Carrier per Channel) FAST feature to enable dynamic allocation and sharing of bandwidth among users.

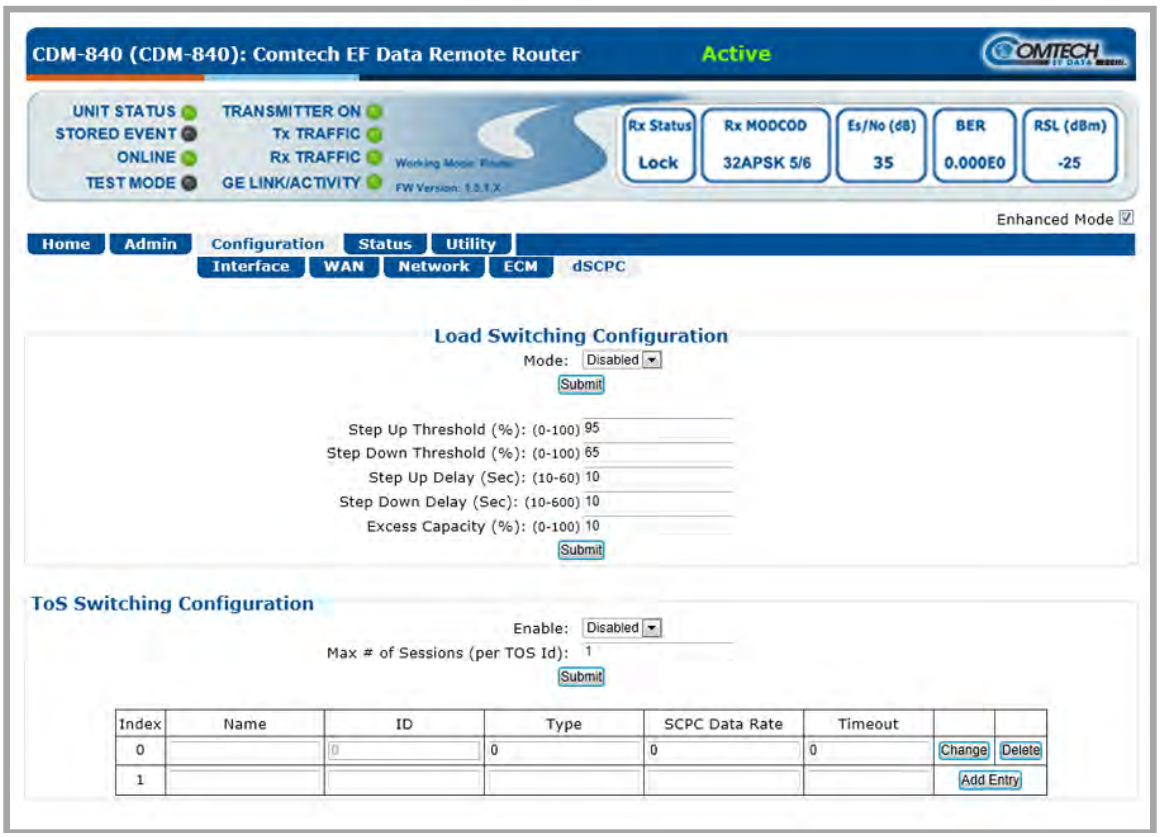


Figure 6-30. Configuration | dSCPC Page

Load Switching Configuration

The acceptable/valid operating ranges for items in this section are provided in parentheses.

- **Mode** – Use the drop-down list to select operation as **Disabled** or **Enabled**. Click **[Submit]** when done.

- **Step Up Threshold** (0 to 100) – Enter the percentage of bandwidth use that will trigger a switch ***up*** from the present SCPC rate to a ***higher*** rate to ensure that there is sufficient bandwidth available for current conditions. Note that this value must be ***greater*** than the value specified for the SCPC *Step Down Threshold*. A typical setting for this parameter is **95%**.

- **Step Down Threshold** (0 to 100) – Enter the percentage of bandwidth use that will trigger a switch ***down*** from the present SCPC rate to a ***lower*** rate to ensure efficient bandwidth usage for current conditions. Note that this value must be ***less*** than the value specified for the SCPC *Step Up Threshold*. A typical setting for this parameter is **65%**.

- **Delay** (1 to 50) – Enter the Switching Delay period, in seconds, to ensure that a premature switch up or down in the SCPC rate does not occur due to a temporary rise or fall in traffic.

- **Excess Capacity** (0 to 100) – Enter the Excess Capacity data rate percentage to be added to the SCPC data rate. This setting makes additional bandwidth available for when demand arises while minimizing Step Up switching events.

ToS Switching Configuration

- **Enable** – Use the drop-down list to select operation as **Disabled** or **Enabled**.

- **Max # of Sessions (per ToS Id)** (1 to 127) – Allows setting a limit for the number of active sessions for a particular ToS switch type. Note that the overall limit for active sessions in the network is 127.

Click **[Submit]** to save.

(ToS Rules Table)

The acceptable/valid operating range for each item in this section is provided in parentheses. From left to right:

Column	Description
Index	The automatically-assigned specific rule internal index number is identified here.
Name	(1 to 20 characters) – Enter a text label for circuit identification.
ID	(1 to 63) – Enter an integer value for the ToS ID.
Type	(64 to 254) – Enter an integer value for the Switch Type to inform the VMS what switching policy to use.
SCPC Data Rate	(16 to 16000) Enter the desired data rate, in kbps, for this service type.
Timeout	(0 to 60) Enter the timer setting, in seconds, for restoring the home state condition once data packet flow stops.

To edit a ToS Switching Configuration rule: Edit the information for the specific indexed rule. Click **[Change]** when done.

To delete a ToS Switching Configuration rule: Click **[Delete]** to delete the specific indexed rule from the ToS Rules Table.

To add a ToS Switching Configuration rule: Enter the information for the new rule. Click **[Add Entry]** when done. The rule will be assigned to the next incremented index number, with **[Change]** and **[Delete]** functionality assigned to the new entry.

6.4.4.6 Status Pages

The **Status** pages provide status, event logging, and operational statistics windows.

Click the **Status** tab, and then select the **Statistics** or **Monitor** tab to continue.

6.4.4.6.1 Status | Statistics Pages

Click the **Statistics | Statistics** tabs, and then select the **Traffic**, **Router**, **Compression**, **QoS**, and for the CDM-840 *only*, the **E1** or **Trending** tab to continue.

6.4.4.6.1.1 Status | Statistics | Traffic

Use this page to view ***read-only,*** abridged status windows pertaining to the basic operational statistics for the Ethernet, Modulator, and Demodulator traffic.

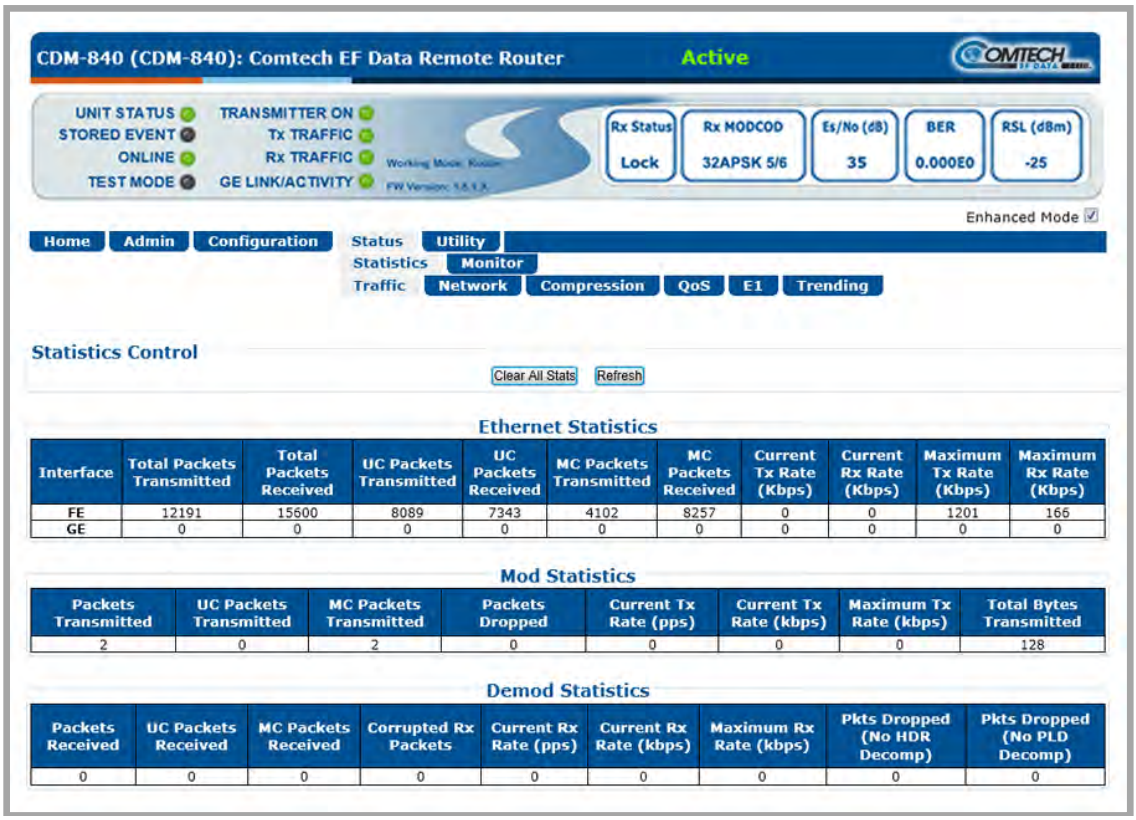


Figure 6-31. Status | Statistics | Traffic Page

Statistics Control

Click **[Clear All Stats]** to clear all operational statistics from the buffer. Otherwise, click **[Refresh]** to update the page with its latest available statistics.

Ethernet Statistics

From left to right:

Column	Description
Total Pkts Xmitted	Total number of packets transmitted.
Total Pkts Rcvd	Total number of packets received.
UC Pkts Xmitted	Unicast packets transmitted.
UC Pkts Rcvd	Unicast packets received.
MC Pkts Xmitted	Multicast packets transmitted.
MC Pkts Rcvd	Multicast packets received.
Current Xmitted (kbps)	Most recent transmitted data rate (in kilobits per second).
Current Rcvd (kbps)	Most recently received data rate (in kilobits per second).
Maximum Xmitted (kbps)	Peak transmitted data rate (in kilobits per second).
Maximum Rcvd (kbps)	Peak received data rate (in kilobits per second).

Mod Statistics

From left to right:

Column	Description
Pkts Xmitted	Packets transmitted.
UC Pkts Xmitted	Unicast packets transmitted.
MC Pkts Xmitted	Multicast packets transmitted.
Pkts Dropped	Packets dropped.
UC Pkts Dropped	Unicast packets dropped.
MC Pkts Dropped	Multicast packets dropped.
Current (kbps)	Most recent symbol rate (in kilobits per second).
Maximum (kbps)	Peak symbol rate (in kilobits per second).
Total Bytes Xmitted	Total number of bytes transmitted.

Demod Statistics

From left to right:

Column	Description
Pkts Rcvd	Packets received.
UC Pkts Rcvd	Unicast packets received.
MC Pkts Rcvd	Multicast packets received.
Pkts Dropped	Packets dropped.
UC Pkts Dropped	Unicast packets dropped.
MC Pkts Dropped	Multicast packets dropped.
Cur Rate (kbps)	Most recent symbol rate (in kilobits per second).
Max Rate (kbps)	Peak symbol rate (in kilobits per second).

6.4.4.6.1.2 Status | Statistics | Network Pages

Precision Time Protocol is not available in this firmware release. The PTP tab, while available and selectable on this interface, is therefore non-functional.

Click the **Status | Statistics | Network** tabs, and then select the **Router** tab to continue.

6.4.4.6.1.2.1 Status | Statistics | Network | Router Page

Use this page to view cumulative traffic information.

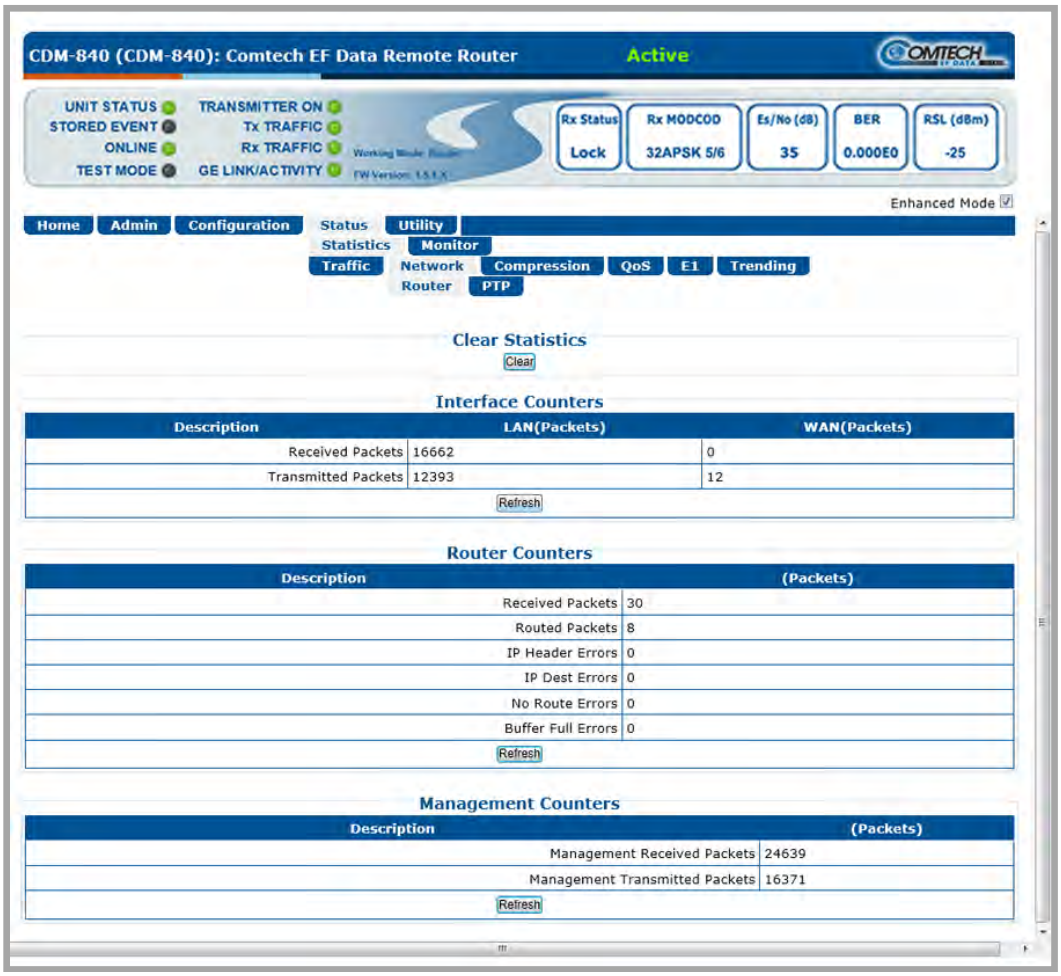


Figure 6-32. Status | Statistics | Network | Router Page

Clear Statistics

Click **[Clear]** to clear all operational statistics from the buffer.

Interface Counters / Router Counters

For each section, click **[Refresh]** to update the section with its latest available statistics.

6.4.4.6.1.3 Status | Statistics | Compression

This page is functional only when Tx and Rx Header and Payload Compression are enabled. Use the* Configuration | WAN | Compression *page (Sect. 6.4.4.5.2.5) to enable or disable Compression operation.

Use this page to view ***read-only*** cumulative WAN, Payload Compression, and Header Compression statistics.

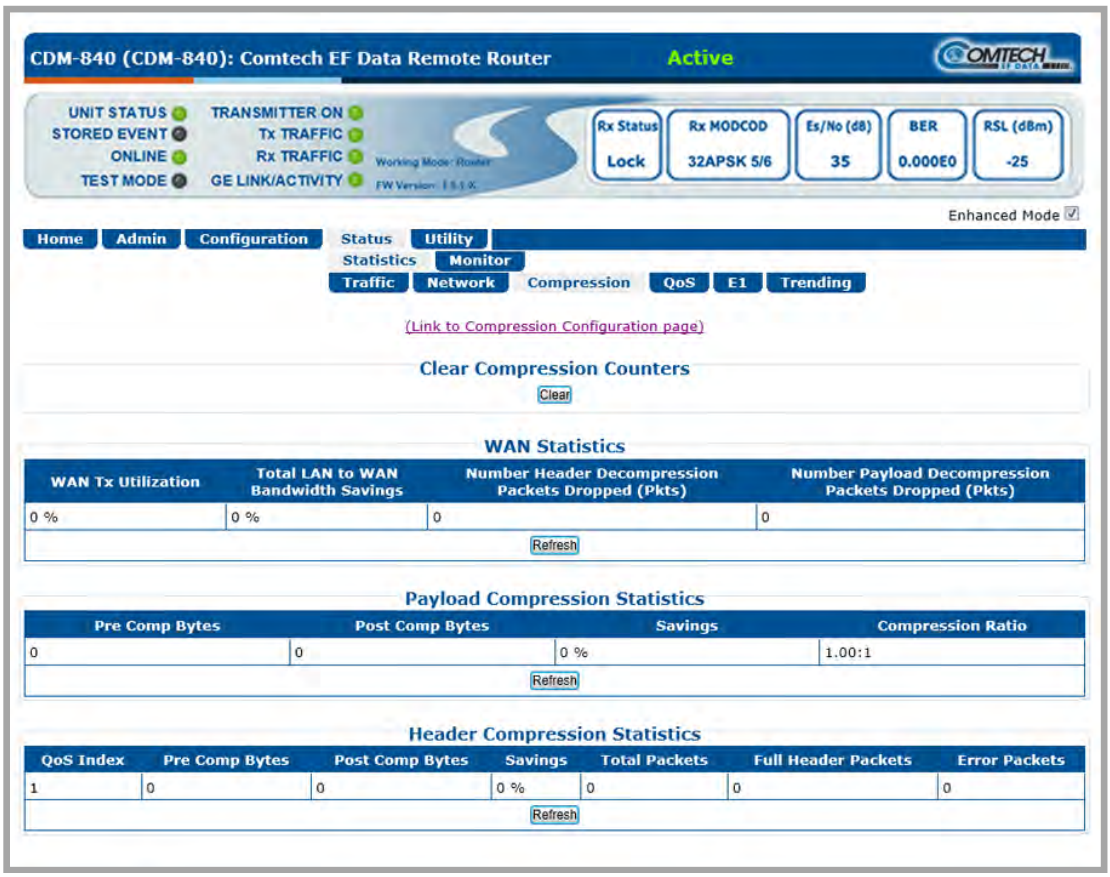


Figure 6-33. Status | Statistics | Compression Page

Click the **(Link to Compression Configuration page)** hyperlink to access the **Configuration | WAN | Compression page (Sect. 6.4.4.5.2.5**).

Clear Compression Counters

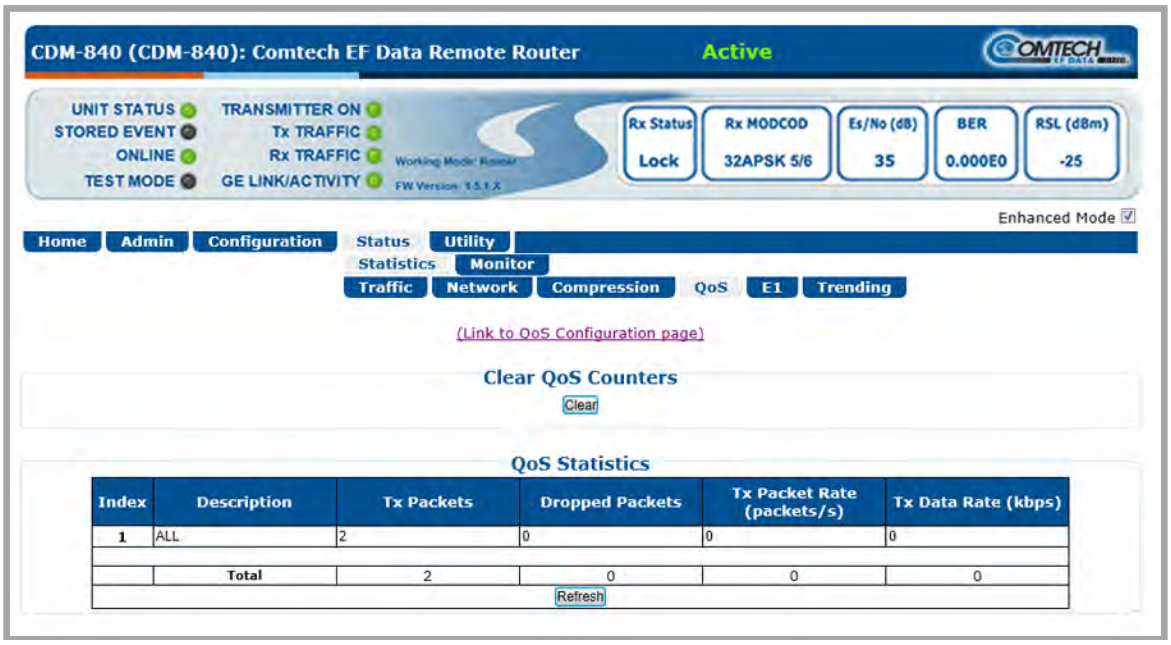
Click **[Clear]** to clear all compression statistics from the buffer.

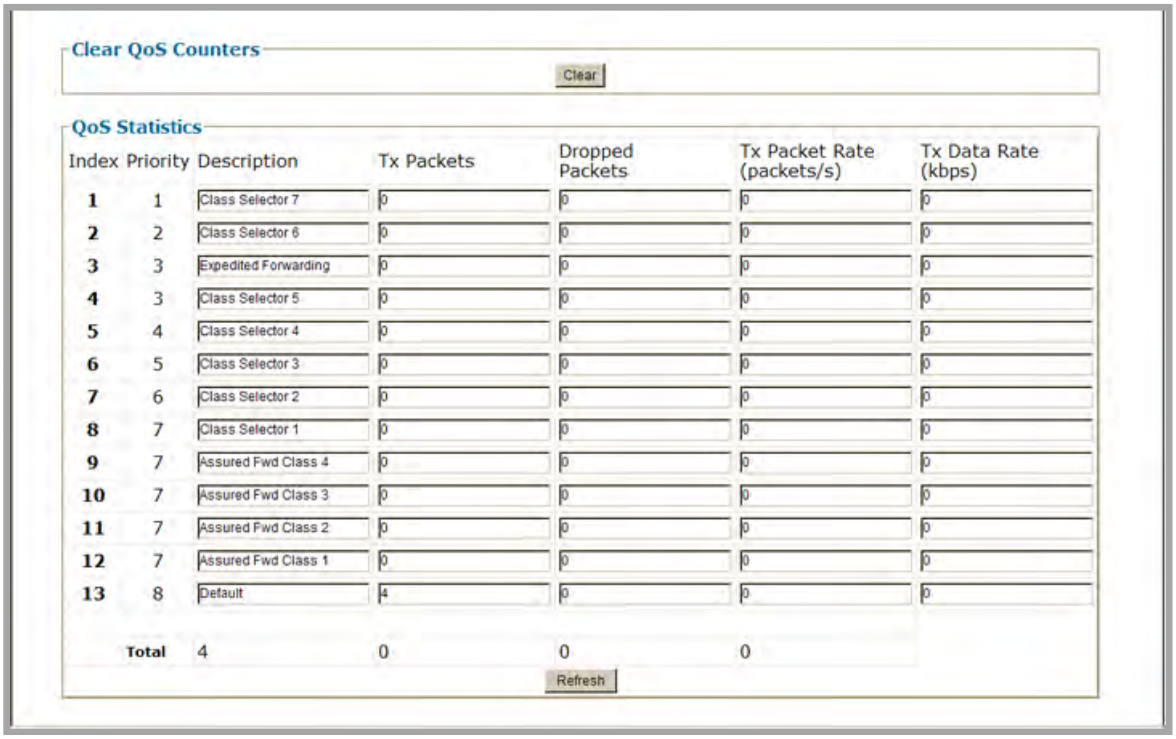
WAN / Payload Compression / Header Compression Statistics

Click **[Refresh]** to update each page section with its latest available statistics.

6.4.4.6.1.4 Status | Statistics | QoS

The appearance of this page changes depending on the selected QoS Control Mode.





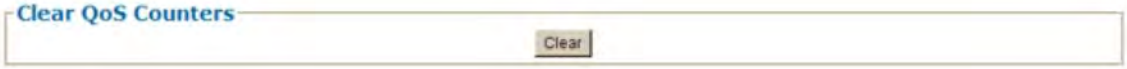
(TOP) Page with QoS Control Mode = OFF, Max/Pri, or Min/Max
(BOTTOM) Page with QoS Control Mode = Diffserv (Banner, VFP, Menu Bar not shown)

Figure 6-34. Status | Statistics | QoS Pages

Click the **(Link to QoS Configuration page)** hyperlink to access the **Configuration | WAN |QoS** page (**Sect. 6.4.4.5.2.3**).

Clear QoS Counters

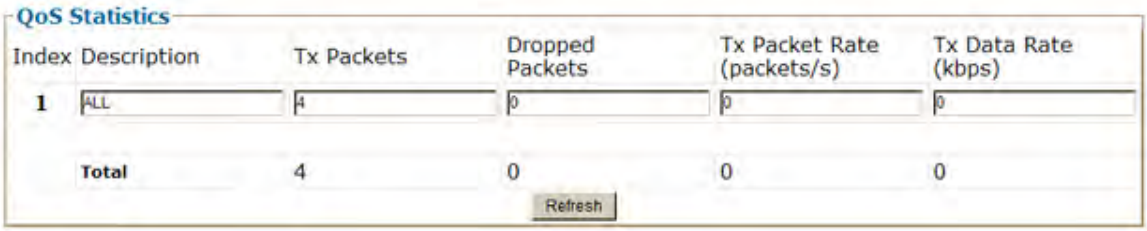
The Clear QoS Counters section is typical for all page configurations. Click* [Clear] *to clear all operational statistics from the buffer.



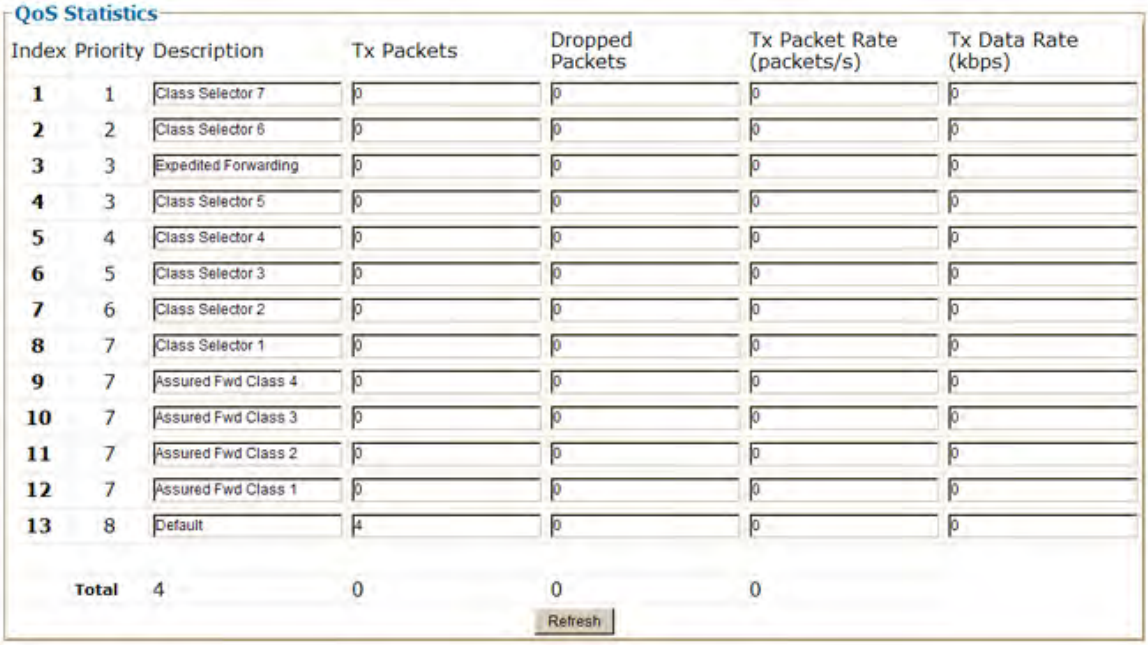
QoS Statistics

The appearance of the QoS Statistics section differs depending on the active page configuration. See the* Configuration | WAN | QoS *page for the definition of the terms used in this table. Click* [Refresh] *to update this section with the latest available statistics.

When QoS Control Mode is set to Off, Max/Pri or Min/Max:



When QoS Control Mode is set to DiffServ:



6.4.4.6.1.5 Status | Statistics | E1 Pages (CDM-840 only)

Use these ***read-only*** pages to view cumulative CDM-840 E1 traffic information. Click the **Status | Statistics| E1** tabs, and then select the **Transmit** or **Receive** tab to continue.

6.4.4.6.1.5.1 Status | Statistics | E1 | Transmit

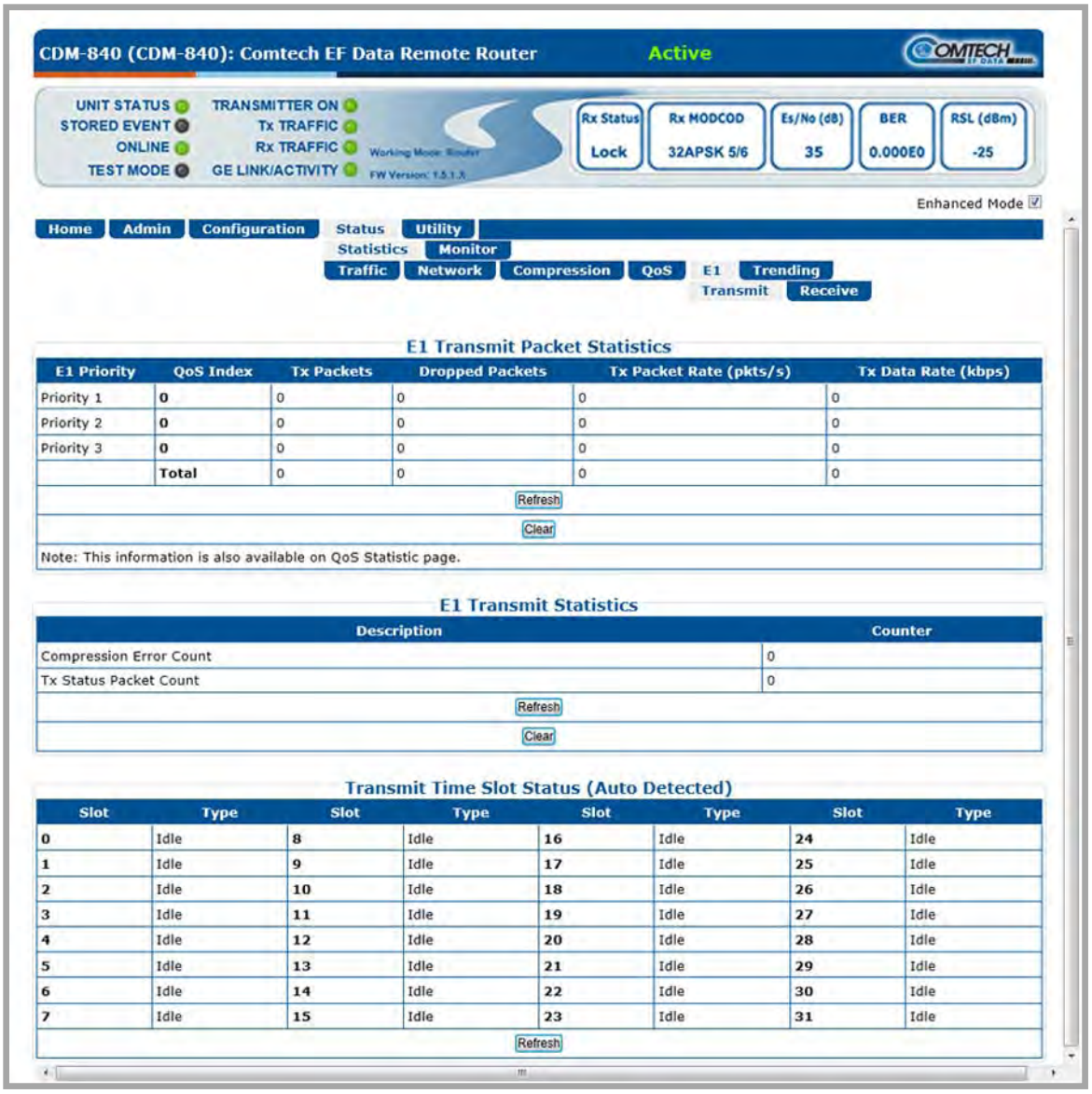


Figure 6-35. Status | Statistics | E1 | Transmit Page

E1 Transmit Packet Statistics

From left to right:

Column	Description
E1 Priority	Priority as related to E1 configuration (inband signaling/configuration is always conveyed as Priority 1).
QoS Index	System-assigned Quality of Service Index.
Tx Packets	Number of packets transmitted.
Dropped Packets	Number of packets dropped (errors or bandwidth limitations).
Tx Packet Rate (pkts/s)	Packet rate (packets per second).
Tx Data Rate (kbps)	Data rate (kilo bits per second).

Click **[Refresh]** to update this section with its latest available statistics.

Click **[Clear]** to clear all E1 Transmit Packet statistics from the buffer.

E1 Transmit Statistics

Row	Description
Compression Error Count	Number of compression errors detected.
Tx Status Packet Count	Number of status packets transmitted (status packets are transmitted every 500ms).

Click **[Refresh]** to update this section with its latest available statistics.

Click **[Clear]** to clear all E1 Transmit Packet statistics from the buffer.

Transmit Time Slot Status (Auto Detected)

- **Slot** – Numbered 0 through 31.
- **Type** – Slots are detected as **Idle** or **Active**. Idle time slots, once detected, do not utilize bandwidth.

Click **[Refresh]** to update this section with its latest available statistics.

6.4.4.6.1.5.2 Status | Statistics | E1 | Receive

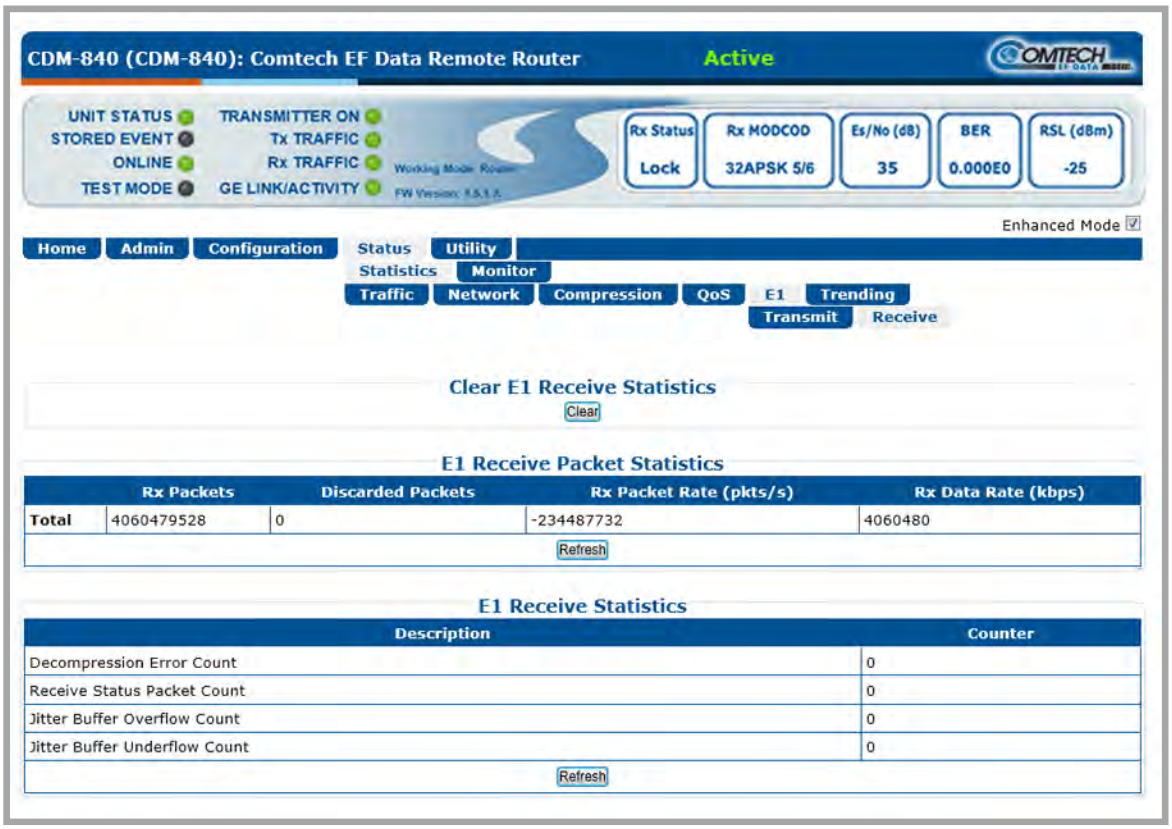


Figure 6-36. Status | Statistics | E1 | Receive Page

Clear E1 Receive Statistics

Click **[Clear]** to clear all E1 Receive Statistics from the buffer.

E1 Receive Packet Statistics

From left to right:

Column	Description
Rx Packets	Number of RAN packets received.
Discarded Packets	Number of discarded Rx packets (errored packets).
Rx Packet Rate (pkts/s)	Current number of packets received (packets per second).
Rx Data Rate (kbps)	Current Rx data rate (kilobits per second).

Click **[Refresh]** to update this section with its latest available statistics.

E1 Receive Statistics

From left to right:

Row	Description
Decompression Error Count	Number of decompression errors detected..
Receive Status Packet Count	Number of status packets received (status packets are received every 500ms).
Jitter Buffer Overflow Count	Number of times that the jitter buffer has overflowed (indicates too much data; jitter latency is not set high enough if count increases consistently).
Jitter Buffer Underflow Count	Number of times that the jitter buffer has underflowed (indicates not enough data; jitter latency is not set high enough if count increases consistently.

Click **[Refresh]** to update this section with its latest available statistics.

6.4.4.6.1.6 Status | Statistics | Trending (CDM-840 only)

Appendix G. WAN/RAN OPTIMIZATION

This page provides an updating graphical representation of several CDM-840 IP traffic handling statistics. When the presence of the optional E1 FAST feature is detected and enabled, E1 RAN Optimization trending characteristics are also provided.

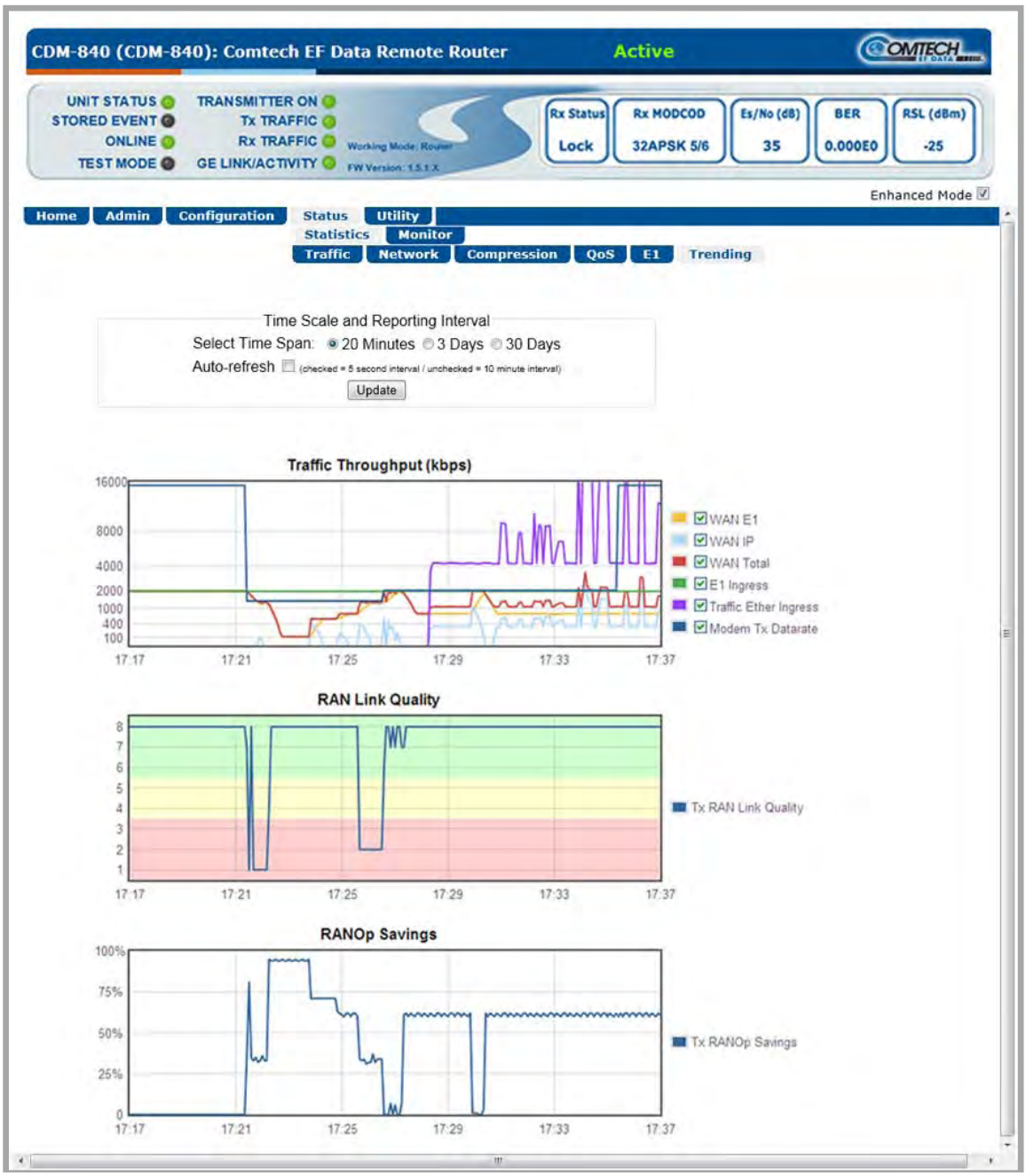


Figure 6-37. Status | Statistics | Trending Page (20 minutes selected)

To initialize the page: Select the Time Span for the graphs as **20 minutes**, **3 Days**, or **30 Days**, and then click **[Update]**. Allow a few seconds for the graphs to visually update.

Traffic Throughput (kbps)

This graph displays utilization of the available data traffic types:

Data Traffic Type	Description
WAN E1	WAN data rate associated with E1/RAN traffic.
WAN IP	WAN data rate associated with IP traffic.
WAN Total	WAN data rate total (WAN E1 + WAN IP).
E1 Ingress	Data rate of E1 time slots carried (64K * number of time slots).
Traffic Ether Ingress	Data rate of Ethernet traffic (WAN/E1 ingress utilization).
Modem Tx Datarate	Modem transmit data rate.

Select as many or as few of the applicable types from the legend to the right of the graph. Allow a few seconds for the graph to display the selected traffic data types.

RAN Link Quality

This graph provides the performance indicator for the Tx RAN Link Quality metric, a qualitative measure of the voice quality predicated by a) the level of compression, and b) traffic packet optimization required to accommodate the incoming traffic into the available WAN (satellite) bandwidth.

Association of the Link Quality Metric to its comparative Link Quality is as follows:

Link Quality Metric	Link Quality
8	Excellent
7	Very Good
6	Good
5	Fair
4	Average
3	Poor
2	Very Poor
1	

Note that ‘8’ on the graph indicates the highest quality, with no voice traffic optimization.

RANOp Savings

This graph provides the performance indicator for Tx RAN Optimization on the actual “percentage of savings” basis.

6.4.4.6.2 Status | Monitor

Use this *read-only* page to view the unit temperature, alarms summary, plus a scrollable window that displays any events and alarms as logged by the unit during normal operation.

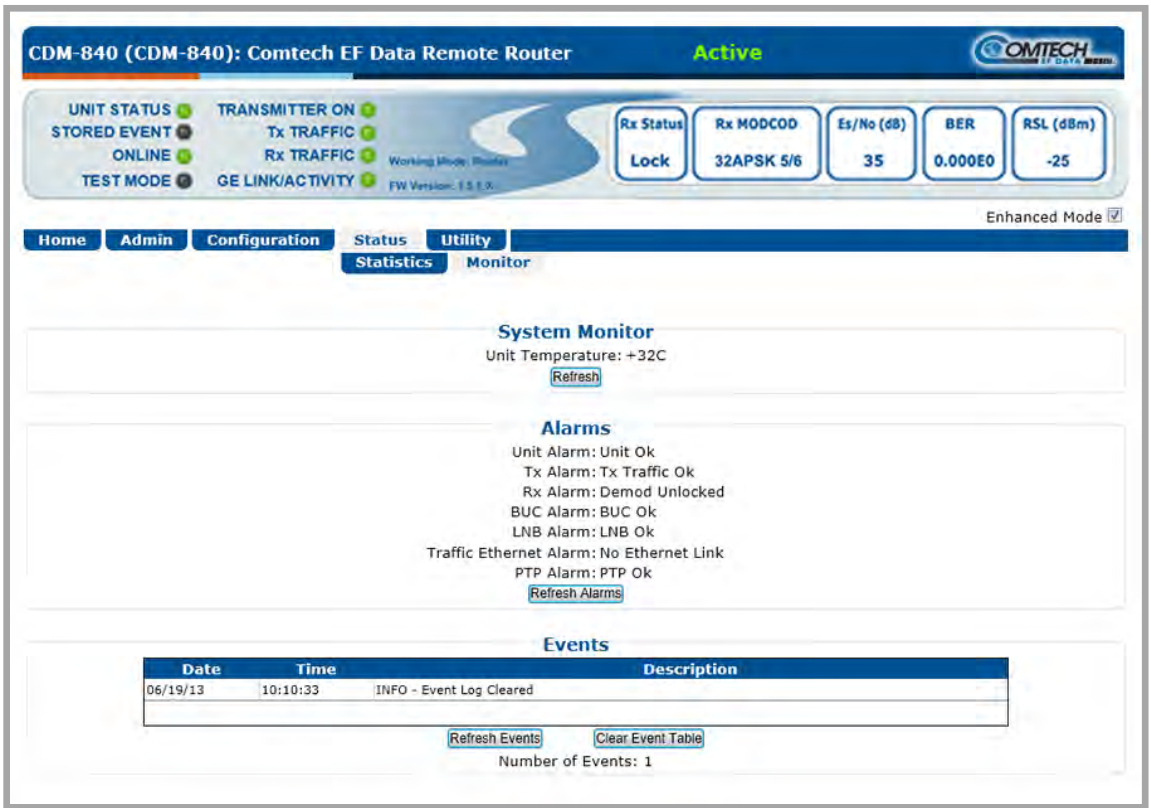


Figure 6-38. Status | Monitor Page

System Monitor

This section displays the operating temperature of the unit (°C). Click **[Refresh]** as needed to update this display.

Alarms

This section tallies the **Unit**, **Tx**, **Rx**, **BUC**, **LNB**, and **Traffic Ethernet** alarms compiled since the logging buffer was last cleared.

Click **[Refresh Alarms]** to update this section with the latest available information.

Events

The 'STORED EVENT' LED provided on the Enhanced Mode Virtual Front Panel lights amber to indicate the presence of any stored event(s) or alarm(s).

Each logged event or alarm is **Date**- and **Time**-stamped, and a **Description** is provided. Click **[Refresh Events]** to update the Events table with the most recently recorded events. Otherwise,

click **[Clear Event Table]** to delete all existing logged entries from the Events log. The log is then reset to one (1) entry: "**INFO – Event Log Cleared**".

6.4.4.7 Utility Pages

Click the **Utility** tab, and then select the **Utility** or **Reboot** tab to continue.

6.4.4.7.1 Utility | Utility

Use this page to access a variety of top-level system operation controls, stored unit configurations, and test utilities.

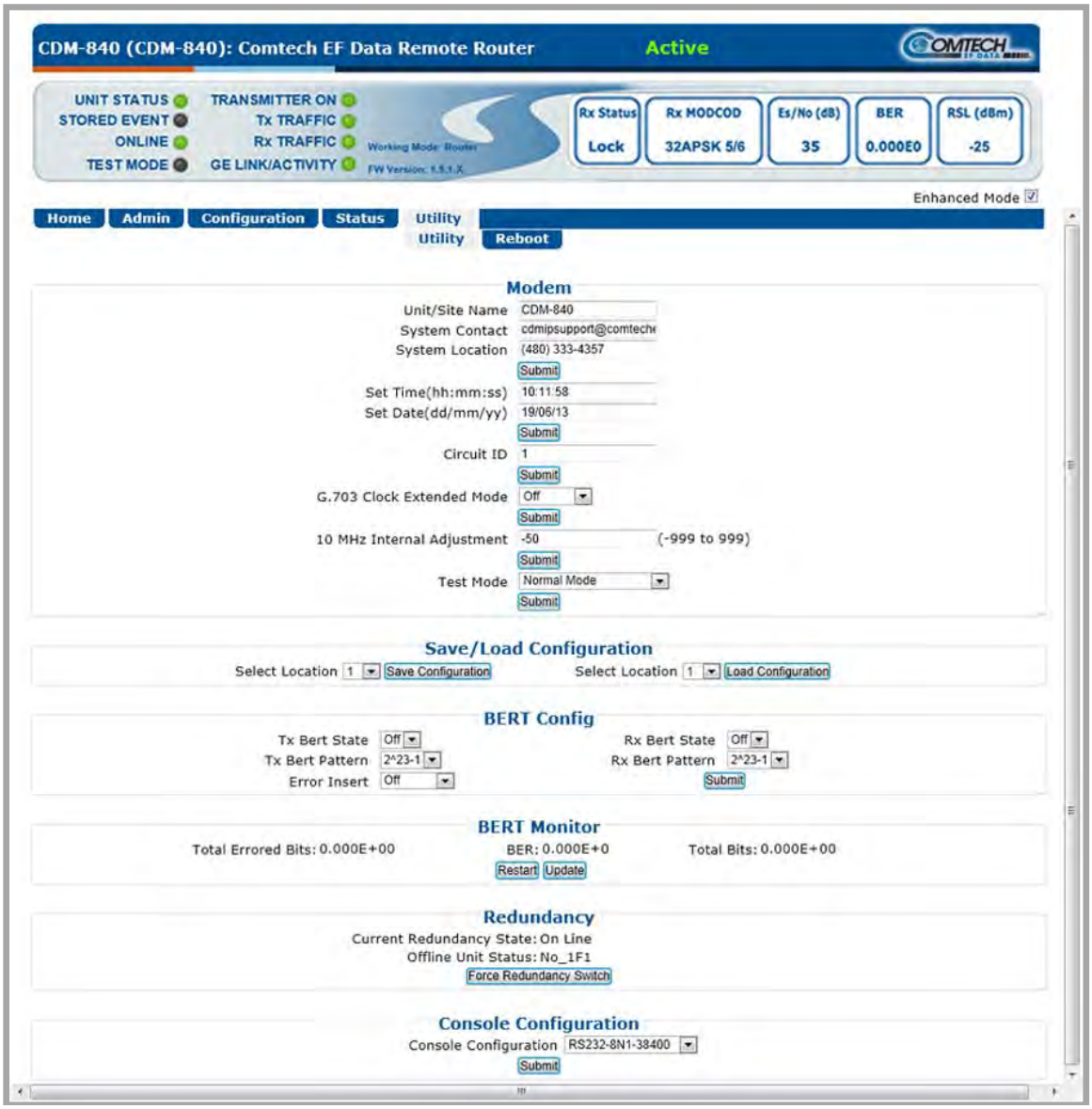


Figure 6-39. Utility | Utility Page

Modem

- **Unit Name –** The product (e.g., **CDM-840**) is identified here.

- **System Contact / System Location –** Comtech EF Data Customer Support e-mail and telephone contact information is provided here.

Enter the desired information. Click **[Submit]** to save.

- **Set Time (hh:mm:ss)** – Use HH:MM:SS format (where HH = hour [00 to 23], MM = minutes [00 to 59], and SS = seconds [00 to 59]) to enter a time.

- **Set Date (dd/mm/yy)** – Use the European time format DD/MM/YY (where DD = day [01 to 31], MM = month [01 to 12], and YY = year [00 to 99]) to enter a date.

Set the **Time** and **Date**. Click **[Submit]** to save.

- **Circuit ID** – Enter a Circuit ID string consisting of 4 to 24 characters, and then click **[Submit]** to save.

- **G.703 Clock Extended Mode** (*CDM-840 only*) – Use the drop-down list to select this operating mode as **Off** or **On**, and then click **[Submit]** to save.

- **10 MHz Internal Adjustment** – Enter a value from -999 to (+)999 to set the adjustment for the Internal 10 MHz High Stability Reference, and then click **[Submit]** to save.

- **Test Mode –** Use the drop-down list to select the operating mode:

Mode	Description
Normal Mode	This mode clears any test modes or loopbacks, and places the unit back into an operational state.
Tx CW	This test mode forces the modulator to transmit a pure carrier (unmodulated).
Tx Alt 1/0	This test mode forces the modulator to transmit a carrier modulated with an alternating 1,0,1,0 pattern, at the currently selected symbol rate. This causes two discrete spectral lines to appear, spaced at +/- half the symbol rate, about the carrier frequency. Use this mode to check the carrier suppression of the modulator.

Select the desired Test Mode. Click **[Submit]** to execute.

Save/Load Configuration

This section allows you to save, and then load (recall) up to 10 configuration sets:

- ***To save a configuration set:***

  - *First,* adjust all operational configuration parameters to suit.

  - *Then,* use the top (Save) **Select Location** dropdown to select **1** through **10.**

  - *Finally*, click **[Save Configuration]** to store the configuration settings.

- ***To load (recall) a configuration set:***

  - First, use the bottom (Load) **Select Location** dropdown to select **1** through **10**.

  - Then, click **[Load Configuration]** to recall the selected configuration settings.

BERT Config

(Where BERT is the acronym for Bit Error Rate Test) Use the drop-down lists to:

- Configure the **Tx** or **Rx BERT State** as **On** or **Off**.

- Configure the **Tx** or **Rx BERT Pattern** as **2^23-1** (2^{23}-1) or **2047**.

- Set **Error Insertion** as either **Off** or **10E-3**.

Select the desired BERT settings. Click **[Submit]** to save the settings and execute the test.

BERT Monitor

This section displays the ongoing BERT. Click **[Restart]** to *restart* the BERT Monitor. Otherwise, click **[Update]** to *refresh* a test already in progress.

Once the Tx BERT is executed, the entire outbound carrier transmits a BERT pattern. All IP communications are halted during this test.

Note also that the Rx BERT State for the CDM-840 must be enabled for a CDM-800 Gateway Router to properly receive and monitor the BERT pattern.

Redundancy

- **Current Redundancy State** (*read-only*) – Status is listed as **On Line** or **Off Line**.

- **Offline Unit Status** (*read-only*) – This indicates the status of the offline unit.

  If the unit is not connected to a redundancy switch, the status is listed as **No_1F1**. Otherwise, its status is listed as **On Line** or **Off Line**.

If the unit is part of a 1:1 or 1:N redundant pair of CDM-840s, and this unit is currently **On Line**, click **[Force Redundancy Switch]** to cause the unit to switch to standby.

Console Configuration

Use the drop-down list to select the desired communications protocol for the rear panel '**CONSOLE**' port. Click **[Submit]** to save. The available selections are:

- RS232-8N1-38400
- RS485-8N1-38400
- RS485-8N1-9600
- RS485-8N1-57600
- RS485-8N1-19200
- RS485-8N1-115200

6.4.4.7.2 Utility | Reboot

Use this page to perform a soft reboot of the CDM-840. Note that the function of this page is identical to the **System Reboot** section of the **Admin | Firmware** page (**Sect. 0**).

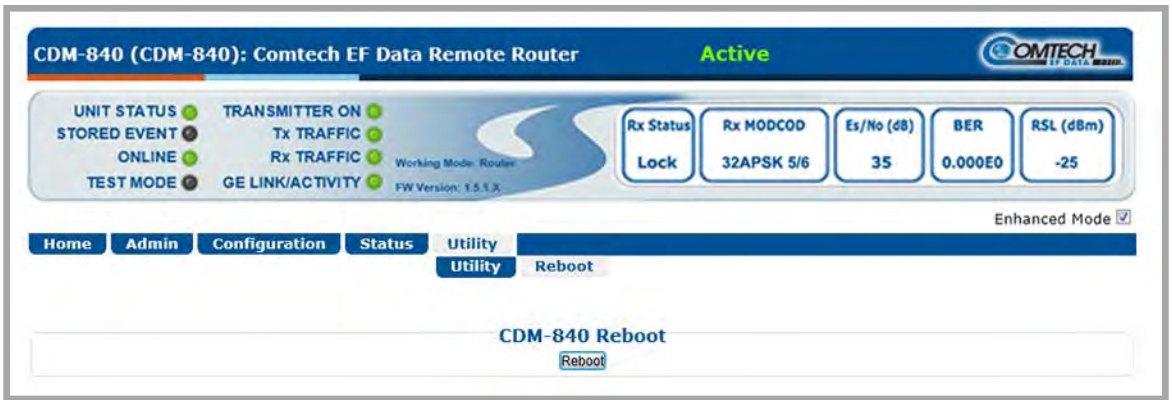
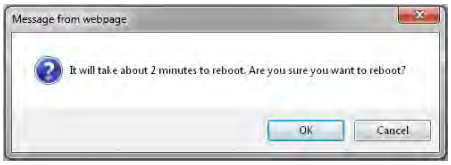


Figure 6-40. Utility | Reboot Page

CDM-840 Reboot

Click **[Reboot]** to reboot the unit. A dialogue box appears to prompt continuation or cancellation of the reboot process:



Click **[OK]** to continue the reboot process, or **[Cancel]** to abort the process and return to the **Utility | Reboot** page.

Once the reboot process resumes, the **Utility | Reboot** page is replaced with the dynamic message "**Please wait...the CDM-840 is rebooting, login available in *XXX* seconds**" – the time count decrements to **0 seconds** before the unit reboots. After the reboot, login is required once again to resume use of the Web Server Interface.

Chapter 7. SERIAL-BASED REMOTE PRODUCT MANAGEMENT

7.1 Introduction

1. ***The Serial-based Remote Product Management Interface is intended to provide two important capabilities:***

   - ***First, it allows you to establish IP communications (Web, SNMP) when the unit is first being configured.***
   - ***Second, the interface allows you to bring the CDM-840 back online through the serial or Telnet Interface over a very slow speed "backup channel".***

   <u>This interface is NOT intended to be a full featured interface to configure all aspects of the modem. Rather, its purpose is to provide enough commands to allow a terminal to be brought back online.</u>

   Once communications have been re-established, the standard interfaces (Web, SNMP, NetVue) can be used complete any additional detailed configuration/control/monitoring functions

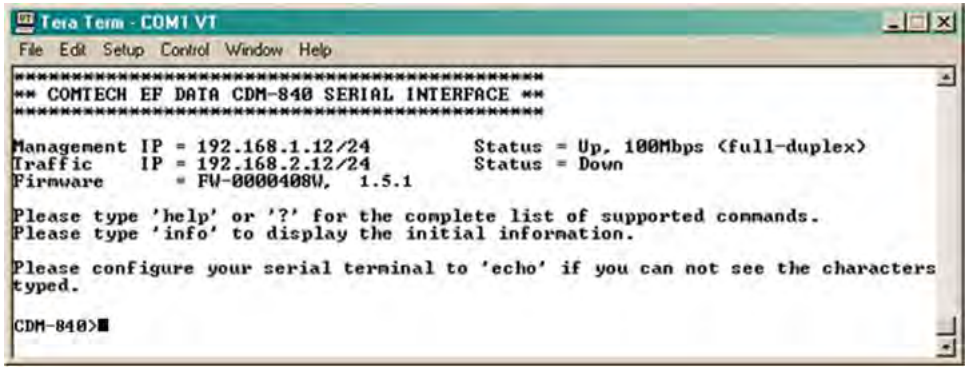
   USE OF THE SERIAL-BASED REMOTE PRODUCT MANAGEMENT INTERFACE IS RECOMMENDED ONLY FOR ADVANCED USERS.

See* Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT *for details on using the CDM-840 SNMP and Web Server Interfaces.

2. To proceed with Serial-based Remote Product Management, assumptions are made that:

- ***The CDM-840 is operating with the latest version firmware files.***
- ***The CDM-840 is connected to a user-supplied, Windows-based PC, and:***
  - ***The PC serial port is connected to the CDM-840 rear panel 'CONSOLE' port using a user-supplied serial cable.***
  - ***The PC Ethernet port is connected to the CDM-840 rear panel 'MANAGEMENT | FE' 10/100 BaseT Ethernet port with a user-supplied hub, switch, or direct Ethernet cable connection.***
  - ***The PC is running a terminal emulation program (for operation of the CDM-840 Serial Interface), and a compatible Web browser (for operation of the CDM-840 Web Server Interface).***
  - ***The CDM-840 Management IP Address has been noted using the CDM-840 Serial Interface.***

Remote product management is available through the EIA-232 operational interface, where the 'Controller' device (the user PC or an ASCII dumb terminal) is connected directly to the 'Target' device (the CDM-840 Remote Router, via its DB-9M 'CONSOLE' port). This connection makes possible serial remote monitor and control (M&C) of the CDM-840 through the CDM-840 Serial Interface.



Through this EIA-232 connection (for the control of a single device), data is transmitted in asynchronous serial form, using ASCII characters. Control and status information is transmitted in packets of variable length in accordance with the structure and protocol defined later in this chapter.

Access to the CDM-840 Serial Interface is accomplished with a user-supplied terminal emulator program such as Tera Term or HyperTerminal. Use this utility program to first configure serial port communication and terminal display operation:

- **38400 bps (Baud Rate)**
- **8 Data Bits**
- **1 Stop Bit**
- **Parity = NO**
- **Port Flow Control = NONE**
- **Display New line Rx/Tx: CR**
- **Local Echo = OFF**

When the user-supplied terminal emulator program is configured correctly, upon power-up of the CDM-840, the CDM-840 Serial Interface Info Screen appears, followed by the **CDM-840>** command prompt. From here, type "**help[cr]"** or "**?[cr]"** (without the quotes) to display the CDM-840 available commands and queries, and to review instructions for using the interface.

Additionally, the CDM-840 also supports the serial command protocol over a Telnet session through the use of a 10/100Base-T Ethernet connection to the CDM-840. The Ethernet communications interface also supports SNMP protocol, and provides a graphical user interface (GUI) through web pages that can be accessed using a web browser such as Internet Explorer.

7.2 Remote Commands and Queries Overview

7.2.1 Basic Protocol

In an EIA-232 configuration, the Controller device is connected directly to the Target device via a two wire-plus-ground connection. All data is transmitted in framed packets as asynchronous serial characters, suitable for transmission and reception to the Controller using a universal asynchronous receiver/transmitter (UART). Controller-to-Target data is carried via EIA-232 electrical levels on one conductor, and Target-to-Controller data is carried in the other direction on the other conductor:

- **Controller-to-Target:** The Controller device (e.g., the user PC via the CDM-840 Serial Interface) is used to transmit instructions (commands) to – or to request information from (queries) – the Target device (i.e., the CDM-840).

- **Target-to-Controller:** The Target, in return, only transmits response information to the Controller when specifically directed by the Controller.

For Serial Remote Control, all issued commands (**Controller-to-Target**) require a response (**Target-to-Controller**). This response is either to return data that has been queried by the Controller, or to confirm the Target's receipt of a command to change the Target's configuration.

7.2.2 Packet Structure

The exchange of information is transmitted, Controller-to-Target and Target-to-Controller, in '**packets**'. Each packet contains a finite number of bytes consisting of printable ASCII characters, excluding ASCII code 127 (DELETE).

In this context, the Carriage Return and Line Feed characters are considered printable. With one exception, all messages from Controller-to-Target require a response – this will be either to return data that has been requested by the Controller, or to acknowledge reception of an instruction to change the configuration of the Target.

Controller-to-Target (Issued Command or Query)						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
< ASCII code 60 (1 character)	 0000 (default) (4 characters)	/ ASCII code 47 (1 character)	 (3 characters)	= *or* ? ASCII codes 61 *or* 63 (1 character)	 (n characters)	Carriage Return ASCII code 13 (1 character)

Packet Example: **<0000/BFR=1[cr]**

Target-to-Controller (Response to Command or Query)						
Start of Packet	Target Address	Address Delimiter	Instruction Code	Code Qualifier	Optional Arguments	End of Packet
> ASCII code 62 (1 character)	 0000 (default) (4 characters)	/ ASCII code 47 (1 character)	 (3 characters)	= *or* ? ASCII codes 61 *or* 63 (1 character)	 (n characters)	Carriage Return ASCII code 13 (1 character)

Packet Example: **>0000/BFR=1[cr][lf]**

Detailed description of the packet components follow.

7.2.2.1 Start of Packet

- **Controller-to-Target:** This is the character '**<**' (ASCII code 60).
- **Target-to-Controller:** This is the character '**>**' (ASCII code 62).

The '**<**' and '**>**' characters indicate the start of packet. They may not appear anywhere else within the body of the message.

7.2.2.2 Target Address

Up to 9,999 devices can be uniquely addressed. In both EIA-232 applications, the permissible range of values is **1** to **9999**. The target addess is programmed into a target unit using the remote control port.

The controller sends a packet with the address of a target - the destination of the packet. When the target responds, the address used is the same address, to indicate to the controller the source of the packet. The controller does not have its own address

7.2.2.3 Address Delimiter

This is the "forward slash" character '**/** ' (ASCII code 47).

7.2.2.4 Instruction Code

With the exception of the **PING** command (see **Sect. 6.3.12**), this is a three-character alphabetic sequence that identifies the message subject.

Wherever possible, each instruction code is named to serve as a mnemonic for its intended operation – e.g., **MLC** for **M**anagement **L**ink **C**onfiguration, **IPA** for Management **IP A**ddress, etc. This aids in the readability of the message, should it be displayed in its raw ASCII form.

Only upper case alphabetic characters may be used ('**A**' to '**Z**', ASCII codes 65 - 90).

7.2.2.5 Instruction Code Qualifier

This is a single character that further qualifies the preceding instruction code. Code Qualifiers obey the following rules:

Controller-to-Target, the only permitted characters are:

Character	Definition
= (ASCII code 61)	This character is used as the Assignment Operator (AO). It establishes that the Instruction Code that precedes it is to be used as a *command* to assign or configure operation. The instruction set that follows serves to assign the Target's new parameter setting or operational value. Example: In a message from Controller-to-Target, IG1=aaa.bbb.ccc.ddd/yy means "set the GE Port IP address to aaa.bbb.ccc.ddd/yy"
? (ASCII code 63)	This character is used as the Query Operator (QO). It establishes that the Instruction Code that precedes it is to be used as a *query* that returns the Target's current configured parameter setting or operational value. Example: *From Controller-to-Target*, IG1? means "what's the current GE Port IP address?"

Target-to-Controller, the only permitted characters are:

Character	Definition
= (ASCII code 61)	This character is used in two ways: a. If the Controller sends a query to the Target – for example, IG1? (meaning "what's current GE Port IP address?") – the Target responds with IG1= aaa.bbb.ccc.ddd/yy, the value for that queried parameter. b. If the Controller sends an instruction to set a parameter to a particular value, and the value sent is valid, the Target acknowledges the message and responds with IG1= (with no message arguments).
? (ASCII code 63)	If the Controller sends an instruction to set a parameter to a particular value, and the value sent is not valid, the Target then acknowledges the message and responds with, for example, SRC? (with no message arguments). This indicates that there was an error in the message sent by the Controller.
! (ASCII code 33)	If the Controller sends an instruction code that the Target does not recognize, the Target responds by echoing the invalid instruction, followed by ! Example: ABC!

Character	Definition
* (ASCII code 42)	If the Controller sends the command to set a parameter to a particular value, and the value sent is valid BUT the router will not permit that particular parameter to be changed at present, the Target acknowledges the message and responds with, for example, MLC* (with message arguments).
# (ASCII code 35)	If the Controller sends a correctly formatted command, BUT the unit is not in Remote Mode, it does not allow reconfiguration and responds, for example, with MLC#.

7.2.2.6 Optional Message Arguments

Arguments are not required for all messages. Arguments are ASCII codes for the characters '**0**' to '**9**' (ASCII codes 48 to 57), period '**.**' (ASCII code 46), and comma '**,**' (ASCII code 44).

7.2.2.7 End of Packet

- **Controller-to-Target:** This is the 'Carriage Return' ([CR]) character (ASCII code 13).
- **Target-to-Controller:** This is the two-character sequence 'Carriage Return', 'Line Feed' ([cr][lf]) (ASCII codes 13 and 10). Both indicate the valid termination of a packet.

7.3 Remote Commands and Queries

7.3.1 Table Indexes

Notes:

1. **<u>Index Columns</u> – Where Column 'C'** = Command, and **Column 'Q'** = Query, columns marked '**X**' designate the instruction code as *Command only*, *Query only*, or *Command or Query*.

2. **<u>In the tables that follow, the following codes are used in the 'Response to Command' column (per Sect. D.5.5):</u>**
   - = Message ok
   - ? Received ok, but invalid arguments were found.
   - ^ Message ok, but unit is in **Ethernet** mode.
   - # Message ok, but unit is not in **Remote** mode.
   - ~ Time out of a pass-through message, either to via EDMAC or a local ODU

Sect. 6.3.2 Transmit (Tx) Parameters Commands and Queries

CODE	C	Q	PAGE
TAR	X	X	6-12
TDR		X	6-11
TFQ	X	X	6-11

CODE	C	Q	PAGE
TMC	X	X	6-12
TPL	X	X	6-11
TSI	X	X	6-12

CODE	C	Q	PAGE
TSR	X	X	6-11
TXO	X	X	6-11
VFQ		X	6-12

Sect. 6.3.3 Receive (Rx) Parameters Commands and Queries

CODE	C	Q	PAGE
RFQ	X	X	6-13
RGS	X	X	6-14
RMC		X	6-13

CODE	C	Q	PAGE
RSI		X	6-14
RSR	X	X	6-13

Sect. 6.3.4 Demodulator Parameters Commands and Queries

CODE	C	Q	PAGE
ESN		X	6-15
RSL		X	6-15

CODE	C	Q	PAGE

Sect. 6.3.5 Transmit (Tx) BERT Command or Query

CODE	C	Q	PAGE
BTX	X	X	6-16

Sect. 6.3.6 Receive (Rx) BERT Command or Query

CODE	C	Q	PAGE
BRX	X	X	6-16

Sect. 6.3.7 BUC (Block Upconverter) Parameters Commands and Queries

CODE	C	Q	PAGE
BCH	X	X	6-17
BCL	X	X	6-17
BDC		X	6-17

CODE	C	Q	PAGE
BDV		X	6-17
BFR	X	X	6-17
BPS	X	X	6-17

CODE	C	Q	PAGE

Sect. 6.3.8 LNB (Low Noise Block Downconverter) Parameters Commands and Queries

CODE	C	Q	PAGE
LNC		X	6-18
LNH	X	X	6-18
LNL	X	X	6-18

CODE	C	Q	PAGE
LNR	X	X	6-18
LPS	X	X	6-18
LVO		X	6-18

CODE	C	Q	PAGE

Sect. 6.3.9 Unit Parameters Commands and Queries

CODE	C	Q	PAGE
ADJ	X	X	6-23
CID	X	X	6-23
DPW	X		6-25
EID		X	6-19
FLT		X	6-22
FRW		X	6-21

CODE	C	Q	PAGE
GLG	X		6-25
IG1	X	X	6-23
IMG		X	6-21
IPA	X	X	6-24
LC1	X	X	6-24

CODE	C	Q	PAGE
MAC		X	6-25
MG1		X	6-25
MLC	X	X	6-24
NPS		X	6-24
REN		X	6-26

CODE	C	Q	PAGE
SBS	X	X	6-22
SNO		X	6-23
SRC	X	X	6-26
SSN	X	X	6-23
SWC	X	X	6-26
SWR		X	6-21

CODE	C	Q	PAGE
TST	X	X	6-23

Sect. 6.3.10 Bulk Configuration String Commands

CODE	C	Q	PAGE
CLD	X		6-27
CST	X		6-27

Sect. 6.3.11 Redundancy Commands and Queries

CODE	C	Q	PAGE
FSW	X		6-27
RED		X	6-27

Sect. 6.3.12 Miscellaneous Utility Commands

CODE	C	Q	PAGE
PING	X	X	6-28

CODE	C	Q	PAGE

7.3.2 Transmit (Tx) Parameters Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Tx Frequency	TFQ	9 bytes	Command or Query. Sets or returns Tx Frequency in the form xxxx.xxxx , where: Range = 950.0000 to 2150.0000 MHz (L-Band) Resolution=100Hz Example: <1/TFQ=0950.9872'cr'	TFQ= TFQ? TFQ * TFQ#	TFQ?	TFQ =xxxx.xxxx (see Description of Arguments)
Tx Data Rate	N/A	10 bytes	Query only. Returns Tx Data Rate in the form dddddd.ddd, where: dddddd.ddd = Tx Data Rate in kbps, from 16 kbps to 16.00 Mbps Resolution=1 bps Example: <1/TDR?'cr' Note: The corresponding data rate will be automatically updated as per the CCM MODCOD or the MODCOD currently being received.	TDR = TDR? TDR *	TDR?	TDR=xxxxxx.xxx (see Description of Arguments)
Tx Symbol Rate	TSR=	10 bytes	Command or Query. Sets or returns Tx Symbol Rate in the form dddddd.ddd, where: dddddd.ddd = Tx Symbol Rate in ksps, from 16ksps to 4.5Msps Example: <1/TSR=002047.999'cr'	TSR= TSR? TSR* TSR#	TSR?	TSR=dddddd.ddd (see Description of Arguments)
Tx Carrier State	TXO=	1 byte	Command or Query. Sets or returns Tx Carrier State in the form x, where: 0=Off 1=On Example: <1/TXO=1'cr'	TXO= TXO? TXO* TXO#	TXO?	TXO=x (see Description of Arguments)
Tx Power Level	TPL=	4 bytes	Command or Query. Sets or returns Tx Power Level in the form sxx.x, where: s = sign [– (negative) or + (positive)] xx.x = power value Tx Output power level for 950 to 2150MHz range is from 0 to -40 dBm. Example: <1/TPL=-13.4'cr'	TPL= TPL? TPL* TPL#	TPL?	TPL=sxx.x (see Description of Arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Tx MODCOD	TMC=	2 bytes	Command or Query. Sets or returns Tx Modulation in the form xx, where: 0=BPSK 0.488 1=QPSK 0.533 2=QPSK 0.631 3=QPSK 0.706 4=QPSK 0.803 5=8-QAM 0.642 6=8-QAM 0.711 7=8-QAM 0.780 8=16-QAM 0.731 9=16-QAM 0.780 10=16-QAM 0.829 11=16-QAM 0.853 12=reserved (auto) All other codes are invalid. Example: <1/TMC=6'cr'	TMC= TMC? TMC* TMC#	TMC?	TMC=xx (see Description of Arguments)
Tx Spectrum Invert	TSI=	1 byte	Command or Query. Sets or returns Tx Spectrum invert in the form x, where: 0=normal 1=inverted Example: <1/TSI =0'cr'	TSI= TSI? TSI* TSI#	TSI?	TSI=x (see Description of Arguments)
Tx Rolloff	TAR=	1 byte	Command or Query. Sets or returns Tx Rolloff slope in the form x, where: 0=20% 1=25% 2=35% Example: <1/TAR=2'cr'	TAR = TAR? TAR * TAR #	TAR?	TAR =x (see Description of Arguments)
VMS Frequency	N/A	9 bytes	Query only. Returns VMS Frequency in the form xxxx.xxxx, where: Range = 950.0000 to 2150.0000 MHz Resolution=100Hz Example: <1/VFQ?'cr'	VFQ = VFQ? VFQ*	VFQ?	VFQ =xxxx.xxxx (see Description of Arguments)

7.3.3 Receive (Rx) Parameters Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Rx Frequency	RFQ=	10bytes	Command or Query. Sets or returns Rx Terminal Frequency (the frequency (MHz) being received from the satellite) in the form xxxxx.xxxx, where: xxxxx.xxxx = 950.0000 MHz to 65000.0000 MHz (L-Band) Resolution=100Hz. Examples: • If RX LO is 00000, then the Rx Frequency is entered as L-Band direct – 950.0000 to 2150.0000; • If RX LO is set in the range of 30000 to 65000, the Rx Frequency is ± the Rx LO, and this will be the resulting L-Band frequency the modem will expect to receive.	RFQ= RFQ? RFQ* RFQ#	RFQ?	RFQ=xxxxx.xxxx (see Description of Arguments)
Rx Symbol Rate	RSR=	10 bytes	Command or Query. Sets or returns Rx Symbol Rate in the form dddddd.ddd, where: dddddd.ddd = Tx Symbol Rate in ksps, from 16ksps to 4.5Msps Example: <1/RSR =002047.999'cr'	RSR = RSR? RSR * RSR #	RSR?	RSR =dddddd.ddd (see Description of Arguments)
Rx MODCOD	N/A	2 bytes	Query only. Returns Rx Demodulationall in the form xx, where: 0=reserved 1=QPSK 1/4 2=QPSK 1/3 3=QPSK 2/5 4=QPSK 1/2 5=QPSK 3/5 6=QPSK 2/3 7=QPSK ¾ 8=QPSK 4/5 9=QPSK 5/6 10=QPSK 8/9 11=QPSK 9/10 12=8PSK 3/5 13=8PSK 2/3 14=8PSK 3/4 15=8PSK 5/6 16=8PSK 8/9 17=8PSK 9/10	RMC? RMC* RMC#	RMC?	RMC=xx (see Description of Arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Rx MODCOD (cont.)			18=16-APSK 2/3 19=16-APSK 3/4 20=16-APSK 4/5 21=16-APSK 5/6 22=16-APSK 8/9 23=16-APSK 9/10 24=32-APSK ¾ 25=32-APSK 4/5 26=32-APSK 5/6 27=32-APSK 8/9 28=32-APSK 9/10 29=reserved 30=reserved 31=reserved 32=auto (future - ACM only) All other codes are invalid. Example: <0/RMC=6'cr'			
Rx Gold Code Sequence Index	N/A	6 bytes	Command or Query. Note: Only valid in DVB-S2 mode. Sets or returns Rx Gold Code Sequence Index in the form xxxxxx, where: xxxxxx = Gold Code Sequence index (0 to 262141) Example: <1/RGS=189063'cr'	RGS= RGS? RGS* RGS#	RGS?	RGS=xxxxxx
Rx Spectrum Invert	N/A	1 byte	Query only. Returns Rx Spectrum Invert in the form x, where: 0=Normal 1=Rx Spectrum Inverted Example: <0/RSI?'cr'	RSI? RSI* RSI#	RSI?	RSI=x (see Description of Arguments)

7.3.4 Demodulator Status Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Rx Signal Level	N/A	5 bytes	Query only. Returns the value of the Rx signal level, in dBm, from -25 to -55 dBm with a tolerance of ±5 dBm. Resolution = 0.5dB. Note the following: If in the range of -25 to -55dBm, returns RSL=-xx.y If >-25dBm, returns SL1=GT-25 (GT = 'greater than') If <-55 dBm, returns SL1=LT-55 (LT = 'less than') Example: <1/RSL?'cr'	N/A	RSL?	RSL=xxxxx (see description of Arguments)
Rx Es/No	N/A	4 bytes	Query only. Returns the value of Es/No in the form xx.x, where: xx.x = valuefrom -1 to -40 dB. Negative sign (-) is implied. Resolution = 0.1 dB. Returns 99.9 if demod is unlocked. Returns +040 for values greater than -40.0 dB. The Es/No number correspond to the value that is displayed on HTTP (virtual front panel) or SNMP. This value is averaged in the background for the previous 16 values. For a faster Es/No reading use REN command. Example: <1/EBN?'cr'	N/A	ESN?	ESN=xxxxx (see Description of Arguments)

7.3.5 Transmit (Tx) BERT Command or Query

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Tx BERT State	BTX=	1 byte	Command or Query. Sets or returns Tx BERT State in the form x, where: 0=Off 1=On Example: <1/BTX=1'cr'	BTX= BTX? BTX#	BTX?	BTX=x (see Description of Arguments)

7.3.6 Receive (Rx) BERT Command or Query

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Rx BERT State	BRX=	1 byte	Command and Query Sets or returns Rx BERT state in the form x, where: 0 = off 1 = on Example: <1/BRX=1'cr'	BRX = BRX? BRX * BRX #	BRX?	BRX=x (see description of arguments)

7.3.7 BUC (Block Upconverter) Parameters Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
BUC Power Supply enable	BPS=	1 byte	Command or Query. Sets or returns the BUC Power Supply control in the form x, where: 0=Disable 1=Enable Example: <1/BPS=1'cr'	BPS= BPS? BPS* BPS#	BPS?	BPS=x (see Description of Arguments)
BUC 10 MHz Reference	BFR=	1 byte	Command or Query. Sets or returns the BUC 10 MHz Reference control in the form x, where: 0=Off 1=On Example: <1/BFR=1'cr'	BFR= BFR? BFR* BFR#	BFR?	BFR=x (see Description of Arguments)
BUC Current Low Limit	BCL=	4 bytes	Command or Query. Sets or returns the BUC Current Low Limit in the form xxxx, where: xxxx = a value from 0 to 4000mA, in 100mA increments. Example: <1/BCL=1200'cr'	BCL= BCL? BCL* BCL#	BCL?	BCL=xxxx (see Description of Arguments)
BUC Current High Limit	BCH=	4 bytes	Command or Query. Sets or returns the BUC Current High Limit in the form xxxx, where: xxxx = a value from 0 to 4000mA, in 100mA increments Example: <1/BCH=2300'cr'	BCH= BCH? BCH* BCH#	BCH?	BCH=xxxx (see Description of Arguments)
BUC DC Current	N/A	4 bytes	Query only. Returns the value of the BUC DC current in the form xxxx, where: xxxx = a value, in mA, from 0 to 9999. If not available, response is 0000. Example: <1/BDC?'cr'	N/A	BDC?	BDC=xxxx (see Description of Arguments)
BUC Voltage	N/A	4 bytes	Query only. Returns the value of the BUC Voltage in the form xx.x, where: xx.x = a value, in volts, from 0 to 64.0 Example: <1/BDV?'cr'	N/A	BDV?	BDV=xx.x (see Description of Arguments)

7.3.8 LNB (Low-Noise Block Downconverter) Parameters Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
LNB Current High Limit	LNH=	3 bytes	Command or Query. Sets or returns the current high limit value in the form xxx, where: xxx = current high limit value from 0 to 500 mA. Example: <1/LNH=123'cr'	LNH= LNH? LNH* LNH#	LNH?	LNH=xxx (see Description of Arguments)
LNB Current Low Limit	LNL=	3 bytes	Command or Query. Sets or returns the current low limit value in the form xxx, where: xxx = current low limit value from 0 to 500 mA. Example: <1/LNL=123'cr'	LNL = LNL? LNL * LNL #	LNL?	LNL =xxx (see Description of Arguments)
LNB Reference Enable	LNR=	1 byte	Command or Query. Sets or returns the LNB Reference Enable in the form x, where: 0=Disable 1=Enable Example: <1/LNR=1'cr'	LNR= LNR? LNR* LNR#	LNR?	LNR=x (see Description of Arguments)
LNB DC Power Control	LPS=	1 byte	Command or Query Sets or returns the LNB DC Power Supply Control in the form x, where: 0 = Off 1 = 13V LNB Voltage 2 = 18V LNB Voltage 3 = 24V LNB Voltage Example: <1/LPS=3'cr'	LPS= LPS? LPS* LPS#	LPS?	LPS=x (see Description of Arguments)
LNB Voltage	N/A	4 bytes	Query only. Returns the LNB voltage value in volts Example: <1/LVO?'cr'	N/A	LVO?	LVO=xxxx (see Description of Arguments)
LNB Current	N/A	4 bytes	Query only. Returns ther LNB current value in mA. Example: <1/LNC?'cr'	N/A	LNC?	LNC=xxxx (see Description of Arguments)

7.3.9 Unit Parameters Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Equipment ID	N/A	37 bytes	Query only. Returns the equipment ID and installed options, where: AAAA= The modem model number, i.e, 0840 ssss (4 spares)= Installed hardware = 0000 Software FAST options B= Tx Data/Symbol Rate option: 0= Standard: CCM 16kbps to 256kbps 1= CCM 16kbps to 512bps 2= CCM 16kbps to 1024kbps 3= CCM 16kbps to 2048kbps 4= CCM 16kbps to 5Mbps 5= CCM 16kbps to 10Mbps 6= CCM 16kbps to 15Mbps 7= ACM 37ksps to 100ksps (future) 8= ACM 37ksps to 200ksps (future) 9= ACM 37ksps to 400ksps (future) A= ACM 37ksps to 800ksps (future) B= ACM 37ksps to 1200ksps (future) C= ACM 37ksps to 2400ksps (future) D= CCM 37ksps to 4100 ksps (future) C= Rx Data/Symbol Rate option: 0= Standard: CCM 1Mbps to 15Mbps 1= CCM 1Mbps to 45Mbps 2= CCM 1Mbps to 100Mbps 3= CCM 1Mbps to 140Mbps 4= CCM 1Mbps to 167Mbps 5= ACM 1Msps to 5Msps *future* 6= ACM 1Msps to 15Msps *future* 7= ACM 1Msps to 34Msps *future* 8= ACM 1Msps to 47Msps *future* 9= ACM 1Msps to 62Msps *future*	N/A	EID?	EID=AAAAssssBCDEFGHIJ Kssssssssssssssssss (see Description of Arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Equipment ID (cont.)			D=E1 Interface – WAN Adaptation: 0= None 1= 1 TRX (up to 3 DSO can be selected) 2= 2 TRX (up to 6 DSO can be selected) 3= 3 TRX (up to 9 DSO can be selected) 4= 6 TRX (up to 18 DSO can be selected) 5= 9 TRX (up to 27 DSO can be selected) 6= 9+ TRX / Full E1 (up to 32 DSO can be selected) E=Header Compression Tx Data Rate (CCM)/ Symbol Rate (ACM): 0= None 1= up to 256 kbps (CCM) / 100 ksps (ACM) 2= up to 512 kbps (CCM) / 200 ksps (ACM) 3= up to 1024 kbps (CCM) / 400 ksps (ACM) 4= up to 2048 kbps (CCM) / 800 ksps (ACM) 5= up to 5 Mbps (CCM) / 1200 ksps (ACM) 6= up to 10 Mbps (CCM) / 2400 ksps (ACM) 7= up to 15 Mbps (CCM) / 4100 ksps (ACM) F=Header Decompression Rx Data Rate (CCM)/ Symbol Rate (ACM): 0= None 1= up to 15 Mbps (CCM) / 5 Msps (ACM) 2= up to 45 Mbps (CCM) / 15 Msps (ACM) 3= up to 100 Mbps (CCM) / 34 Msps (ACM) 4= up to 140 Mbps (CCM) / 47 Msps (ACM) 5= up to 167 Mbps (CCM) / 62 Msps (ACM) G=Payload Compression Tx Data Rate (CCM)/ Symbol Rate (ACM): 0= None 1= up to 256 kbps (CCM) / 100 ksps (ACM) 2= up to 512 kbps (CCM) / 200 ksps (ACM) 3= up to 1024 kbps (CCM) / 400 ksps (ACM) 4= up to 2048 kbps (CCM) / 800 ksps (ACM) 5= up to 5 Mbps (CCM) / 1200 ksps (ACM) 6= up to 10 Mbps (CCM) / 2400 ksps (ACM) 7= up to 15 Mbps (CCM) / 4100 ksps (ACM) H=Payload Decompression Rx Data Rate (CCM)/ Symbol Rate (ACM): 0= None 1= up to 15 Mbps (CCM) / 5 Msps (ACM) 2= up to 45 Mbps (CCM) / 15 Msps (ACM) 3= up to 100 Mbps (CCM) / 34 Msps (ACM) 4= up to 140 Mbps (CCM) / 47 Msps (ACM) 5= up to 167 Mbps (CCM) / 62 Msps (ACM)			

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Equipment ID (cont.)			I = Quality of Service 0= None 1= Basic Qos (Diffserv + SAR) 2= Advanced Qos (Basic Qos + Rule Based Qos) J = G.702 Clock Extension 0= None 1= Enabled K = Dynamic SCPC 0= None 1= Enabled ssssssssssssssssss (19 spares) Example: <1/EID?'cr'			
Current Software Image	N/A	1 byte	Query Only. Returns active software image in the form x, where: 1=Bulk Image #1 currently active 2=Bulk Image #2 currently active Example: <1/IMG?'cr'	N/A	IMG?	IMG=x (see Description of Arguments)
Firmware information	N/A	100 bytes	Query only. Returns firmware information for Image 0, 1 or 2, where: 0 = Bootrom Information 1 = Image #1 Firmware Information 2 = Image #2 Firmware Information The information return in the form xxxxx…,mm/dd/yy where: xxxxx…: The firmware number mm/dd/yy: The firmware date in month/date/year Example: <0/FRW?1'cr'	N/A	FRW?0 FRW?1 FRW?2	FRW= xxxxx…,mm/dd/yy (see Description of Arguments)
Software Revision	N/A	8 bytes	Query only. Returns the value of the internal software revision installed in the unit, in the form of xx.xx.xx Example: <0/SWR?'cr'	N/A	SWR?	SWR=xx.xx.xx (see description of Arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Faults and Status	N/A	16 bytes	Query only. Returns the current *highest-priority* fault and status codes for the Unit (hardware), TX Traffic, RX Traffic, and ODUs in the form abcdefxxxxxxxxxx, where: a = Unit status: 0=No faults 1=Power supply fault, +5 volts 2=Power supply fault , +12 volts 3=Tx synthesizer unlocked 4=Tx/Rx FPGA PLL unlocked 5=Tx/Rx FPGA load fail 6=Compression FPGA load fail b = Tx Traffic status: 0=Tx traffic OK c = Rx Traffic status: 0=Rx Traffic OK 1=Demodulator unlocked 2=Es/No Alarm d = BUC status/faults: 0=BUC OK 1=BUC Current 2=BUC Voltage e = LNB status/faults: 0 = OK, masked or not present 1 = LNB current 2 = LNB voltage f = Traffic/GE Interface Fault (reports as Unit Fault) 0 = OK 1 = No Link ssssssssssssssssss (10 spares) Example: <0/FLT?'cr'	N/A	FLT?	FLT= abcdefxxxxxxxxxx (see Description of Arguments)
Software Boot From Slot	SBS=	1 byte	Command or Query. Selects which bulk firmware slot to boot from in the form x, where: 0=Latest Firmware (most recent date) 1=Firmware is Slot #1 2=Firmware is Slot #2 Example: <1/SBS=1'cr'	SBS= SBS? SBS* SBS#	SBS?	SBS=x (see Description of Arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
SNMP Unit Name	SSN=	16 bytes	Command or Query. Sets or returns the SNMP System Name string Example: <1/SSN=Remote1. *Note: If not configured it returns empty string*	SSN = SSN!	SSN?	SSN =x [1..16] (see Description of Arguments)
Serial Number	N/A	9 bytes	Query only. Returns the 9-digit serial number. Example: <1/SNO?'cr'	N/A	SNO?	SNO=xxxxxxxxx (see Description of Arguments)
Adjustment for Internal 10MHz High-stability Reference	ADJ=	4 bytes	Command or Query. Sets or returns the fine adjustment of the Internal 10MHz Reference on the High-Stability Frequency Reference module in the form sddd, where: s= sign [– (negative) or + (positive)] ddd= value, 0-999. Example: <1/ADJ=-123'cr'	ADJ= ADJ? ADJ* ADJ#	ADJ?	ADJ=sddd (see Description of Arguments)
Circuit ID String	CID=	4 to 32 bytes	Command or Query. Sets or returns the user-defined Circuit ID string, which is 4 to 32 characters in length. Valid characters include: Space ( ) * + – , . / 0 9 and A thru Z Example: <1/CID=RxCircuitID'cr'	CID= CID? CID* CID#	CID?	CID=x [4..32] (see Description of Arguments)
Unit Test Mode	TST=	1 byte	Command or Query. Sets or returns Unit Test Mode in the form x, where: 0=Normal Mode (no test) 1=Tx CW 2=Tx Alternating 1,0 Pattern 3 = QPSK PN Pattern Example: <1/TST=1'cr'	TST= TST? TST* TST#	TST?	TST=x (see Description of Arguments)
Traffic IP	IG1=	18 bytes	Command or Query. Sets or returns the IP address and network prefix for the 10/100 BaseT Ethernet Traffic port, in the form xxx.xxx.xxx.xxx/yy, where: xxx.xxx.xxx.xxx is the IP address, and yy is the network prefix (8-30) Example: <1/IG1=192.168.001.004/24'cr'	IG1= IG1? IG1* IG1#	IG1?	IG1= xx.xxx.xxx.xxx/yy (See description of arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
GE Link Configuration	LC1=	1 byte	Command or Query. Sets or returns GE Interface mode in the form x, where: 0=Auto Negotiate 1=1000Mbps -Full Duplex 2=100Mbps – Full Duplex 3=100Mbps – Half Duplex 4=10Mbps – Full Duplex 5=10Mbps – Half Duplex Example: <1/LC1=3'cr'	LC1= LC1? LC1* LC1#	LC1?	LC1=x (see Description of Arguments)
Actual Negotiated Port Speed	N/A	None	Query only. Returns actual negotiated port speed in the form ab, where: a = GE1 negotiated port speed. b = management port negotiated port speed. a, b have the following values: 0 = Link down 1=100 Full 2=100 Half 3=10 Full 4=10 Half 5=1000 Full Example: <1/NPS?'cr'	N/A	NPS?	NPS=ab (see Description of Arguments)
Management IP Address	IPA=	18 bytes	Command or Query. Sets or returns set the IP address and network prefix for the 10/100 BaseT Ethernet management port, in the form xxx.xxx.xxx.xxx/yy, where: xxx.xxx.xxx.xxx is the IP address, and yy is the network prefix (8-30) Example: <1/IPG=192.168.001.004/24'cr'	IPA= IPA? IPA* IPA#	IPA?	IPA= xx.xxx.xxx.xxx/yy (See description of arguments)
Management Link Configuration	MLC=	1 byte	Command or Query. Sets or returns Management Interface mode in the form x, where: 0=Auto Negotiate 1=reserved 2=100Mbps – Full Duplex 3=100Mbps – Half Duplex 4=10Mbps – Full Duplex 5=10Mbps – Half Duplex Example: <1/MLC=3'cr'	MLC = MLC? MLC * MLC #	MLC?	MLC =x (see Description of Arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Default Passwords	DPW=	N/A	Command Only. Resets the admin username/password to: Username = “comtech” Password = “comtech”	DPW= DPW? DPW* DPW#	N/A	N/A
Geographical Log Information	GLG=	18 bytes	Command Only. Format is: AAAAOOOOOXNNNNNNNN, where: A = Latitude, O = Longitude, X = exclusion zone status (0 or 1), N = name of satellite used Data is stored in the file “GPS.log.” Data in the log file older then one year is removed from the log file. The format of the text in the log file is a single GLG command per line: WWWWSSSSSSSSFFFFFFFFBBBBBBBBMAAAAOOOOONNNNNNNN, where: W = hex representation of the weeks field (weeks since 1/6/1980) S = hex representation of the seconds field (seconds this week) F = hex representation of the tx frequency B = hex representation of the tx symbol rate bitmap for exclusion setting from user, and if we are locked from the router bit 0 = lock, bit 1 = exclusion bit A = Latitude from user input O = Longitude from user input String for satellite name (doesn't have to be 8 chars exactly, but can't be more then 8)	GLG= GLG?	N/A	GLG= AAAAOOOOOXNNNNNNNN (See Description of Arguments)
Management MAC Address	N/A	12 bytes, alpha-numerical	Query only. Returns the unique MAC Address for the router. Example: MAC=0006B00001C2	N/A	MAC?	MAC=aabbccddeeff (see Description of Arguments)
GE MAC Address	N/A	12 bytes, alpha-numerical	Query only. Returns the unique GE MAC Address. Example: MG1=0006B00001C2	N/A	MG1?	MG1=aabbccddeeff (see Description of Arguments)

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Reported Es/No	N/A	5 bytes	Query Only. Returns current Es/No of demodulator where: s = '0' or '-' (negative sign, if needed, zero otherwise) xx.x = value from 00.0 to 35.0 dB. Resolution = 0.1 dB. Returns 999 if demod is unlocked. Returns 35.0 for values greater than 35.0dB. Note: This query provides a fast Es/No reading that is updated in the background 10 times per second, and is also averaged in the background over the previous 16 returned values.	N/A	REN?	REN=sxx.x (see Description of Arguments)
SNMP Read Community	SRC=	16 bytes, characters, no spaces	Command or Query. SNMP read community string. Example: <1/SRC=public Note: Empty string is not allowed.	SRC = SRC!	SRC?	SRC =x (see Description of Arguments)
SNMP Write Community	SWC=	16 bytes, characters, no spaces	Command or Query. SNMP write community string. Example: <1/SWC =public Note: Empty string is not allowed.	SWC = SWC!	SWC?	SWC =x (see Description of Arguments)

7.3.10 Bulk Configuration String Commands

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Configuration Load	CLD=	1 byte	Command only. Retrieves a previously stored modem configuration from Configuration Memory location defined by the one-byte argument (0 to 9). Example: <1/CLD=4'cr'	CLD= CLD? CLD* CLD#	N/A	N/A
Configuration Save	CST=	1 byte	Command only. Stores the current modem configuration in Configuration Memory location defined by the one-byte argument (0 to 9). Example: <1/CST=0'cr'	CST= CST? CST* CST#	N/A	N/A

7.3.11 Redundancy Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
Redundancy State	N/A	1 byte	Query only. Returns the redundancy state of the unit in the form x, where: 0=Offline 1=Online Example: <1/RED?'cr'	N/A	RED?	RED=x (see description of Arguments)
Force 1:1 Switch	FSW=	None	Command only. Forces the unit to toggle the Unit Fail relay to the "fail" state for approximately 500ms. If the unit is a 1:1 pair and it is currently the 'Online' unit, this forces a switchover so the unit will then be in 'Standby' mode. The command is always executed by the unit regardless of whether it is stand-alone, in a 1:1 pair, or part of a 1:N system. Note: This command takes no arguments. Example: <1/FSW='cr'	FSW= FSW*	N/A	N/A

7.3.12 Miscellaneous Utility Commands and Queries

Parameter Type	Command (Instruction Code & Qualifier)	Number of Arguments for Command or Response to Query	Description of Arguments (Note that all arguments are ASCII numeric codes from 48 and 57)	Response to Command (Target to Controller)	Query (Instruction Code & Qualifier)	Response to Query (Target to Controller)
	PING	None	Command only. Sending four 64-byte ICMP echo request packets to the host and waiting for the ICMP response. The host IP address is in the format: xxx.xxx.xxx.xxx, where: xxx.xxx.xxx.xxx is the IP address Example: <1/PING'sp'xxx.xxx.xxx.xxx'cr'	PING = PING ? PING * PING #	N/A	N/A

Appendix A. REFERENCE DOCUMENTATION

This appendix describes features that may be monitored or controlled by the user, or otherwise processed by the CDM-840 Remote Router. For detailed reading about the operational features of the Advanced VSAT Series group of products, consult the adjunct documentation that is specified in this appendix and is available for download from Comtech EF Data's web site (www.comtechefdata.com).

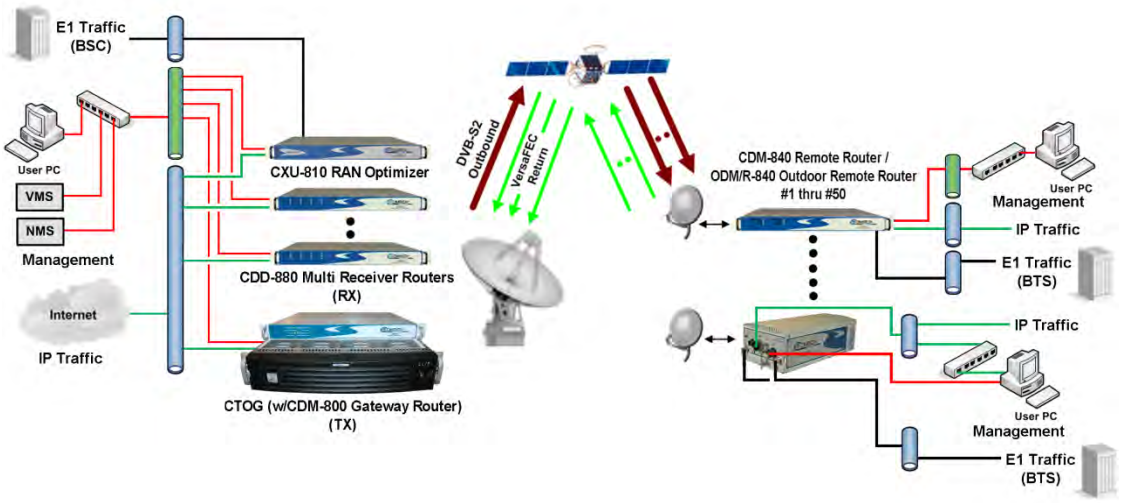


Figure A-1. Advanced VSAT Series Hub and Remote Site Products

A.1 FEC (FORWARD ERROR CORRECTION) OPTIONS

The method of FEC used among Comtech EF Data's Advanced VSAT series of products differs according to Advanced VSAT Series product.

For the CDM-840 and ODM/R-840 Remote Routers: The FEC method used by the remote site CDM-840, ODM-840, and ODMR-840 Remote Routers depends on the direction of signal processing in use:

- **The receive (Rx) side** of the 840 operates with error correction based upon the DVB-S2 standard for QPSK, 8PSK, 16APSK and 32APSK with concatenated **L**ow **D**ensity **P**arity **C**ode (LDPC) and **B**ose-**C**haudhuri-**H**ocquenghem (BCH).

- **The transmit (Tx) side** of the 840 uses the **VersaFEC®** family of short-block LDPC codes**.**

- **Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in this manual**
- **Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in the Comtech EF Data ODM-840 Outdoor Remote Router / ODMR-840 Reduced Form Factor Outdoor Remote Router Installation and Operation Manual (CEFD P/N MN-ODM840)**

For the CDM-800 Gateway Router via the CTOG-250 Comtech Traffic Optimization Gateway: The FEC method used by the hub site CDM-800 is based upon the DVB-S2 standard for QPSK, 8PSK, 16APSK and 32APSK with concatenated Low Density Parity Code (LDPC) and Bose-Chaudhuri-Hocquenghem (BCH).

- **Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in the CTOG-250 Comtech Traffic Optimization Gateway Installation and Operation Manual (CEFD P/N MN-CTOG250)**

For the CDD-880 Multi Receiver Router: The FEC method used by the hub site CDD-880 Multi Receiver Router is a family of short-block Low Density Parity Check (LDPC) codes with very low latency called VersaFEC®. It is a patent pending technology wholly owned and developed by Comtech EF Data and CEFD sister division Comtech AHA Corp. (the VersaFEC name is a trademark registered to Comtech AHA).

Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS in the Comtech EF Data CDD-880 Multi Receiver Router Installation and Operation Manual (CEFD P/N MN-CDD880)

A.2 Adaptive Coding and Modulation / Variable Coding and Modulation (ACM/VCM)

The VersaFEC® Adaptive Coding and Modulation (ACM) feature is a patents-pending technology owned and developed by Comtech EF Data and CEFD sister division Comtech AHA Corp. ACM turns fade margin into increased link capacity by automatically adapting the modulation type and FEC code rate to give highest possible throughput. ACM maximizes throughput regardless of link conditions (noise or other impairments, clear sky, rain fade, etc).

Outbound ACM operation is available in the CDM-800 Gateway Router via the CTOG-250 Comtech Traffic Optimization Gateway, and ACM operation is available in the CDM-840 / ODM/R-840 Remote Routers and CDD-880 Multi Receiver Routers.

- **Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT in this manual**
- **Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT in the Comtech EF Data ODM-840 Outdoor Remote Router / ODMR-840 Reduced Form Factor Outdoor Remote Router Installation and Operation Manual (CEFD P/N MN-ODM840)**
- **Chapter 7. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT *and* Appendix E. OUTBOUND ACM (ADAPTIVE CODING AND MODULATION) in the Comtech EF Data CTOG-250 Comtech Traffic Optimization Gateway Installation and Operation Manual (CEFD P/N MN-CTOG250)**
- **Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT in the Comtech EF Data CDD-880 Multi Receiver Router Installation and Operation Manual (CEFD P/N MN-CDD880)**

A.3 Bridge Point-to-Multipoint (BPM) Operation

The Advanced VSAT BPM feature functions as a Learning Ethernet Switch when the "Working Mode" is set to BPM. This makes the Advanced VSAT equipment appear as a "Sky Ethernet Switch" and allows for a greatly simplified network deployment.

In BPM Mode, all L2/L3/L4 protocols such as VLAN, MPLS, IPv6, OSPF, and BGP will flow through the network as they would through an off-the-shelf Ethernet Switch.

The Advanced VSAT System, running in BPM Mode, supports Flat Networks, Flat Networks with Routers, and VLAN Trunking network topologies.

- **Appendix C. BRIDGE POINT-TO-MULTIPOINT (BPM) OPERATION in this manual.**
- **Appendix C. BRIDGE POINT-TO-MULTIPOINT (BPM) OPERATION in the Comtech EF Data ODM-840 Outdoor Remote Router / ODMR-840 Reduced Form Factor Outdoor Remote Router Installation and Operation Manual (CEFD P/N MN-ODM840)**
- **Appendix C. BRIDGE POINT-TO-MULTIPOINT (BPM) OPERATION in the Comtech EF Data CTOG-250 Comtech Traffic Optimization Gateway Installation and Operation Manual (CEFD P/N MN-CTOG250)**
- **Appendix C. BRIDGE POINT-TO-MULTIPOINT OPERATION (BPM) in the Comtech EF Data CDD-880 Multi Receiver Router Installation and Operation Manual (CEFD P/N MN-CDD880)**

A.4 E1 WAN/RAN Optimization

E1 RAN (Radio Access Network) Optimization technology, jointly developed by Comtech EF Data, CEFD sister division Comtech AHA Corp., and CEFD subsidiary Memotec Inc., is used to significantly reduce the Wide Area Network (WAN) / satellite bandwidth required to carry an E1 bearer used for cellular backhaul. It is a feature available with the CDM-840 and ODM/R-840 Remote Routers and the CXU-810 RAN Optimizer.

- **Appendix G. WAN/RAN OPTIMIZATION in this manual.**
- **Appendix G. WAN/RAN OPTIMIZATION in the Comtech EF Data ODM-840 Outdoor Remote Router / ODMR-840 Reduced Form Factor Outdoor Remote Router Installation and Operation Manual (CEFD P/N MN-ODM840)**
- **Memotec CX-U Series Hardware Reference Manual (Memotec Inc. P/N CX-U-HW-Guide)**

A.5 Entry Channel Mode (ECM)

ECM operation is available in the CDM-840 and ODM/R-840 Remote Routers, and the CDD-880 Multi Receiver Router. ECM is a feature based on slotted Aloha with random retransmission backoff. It supports multiple carriers through frequency assignments, which provide simplified deployment and scalability.

While a CDM-840 or ODM/R-840 is in Entry Channel Mode, it allows the passing of management traffic only – it will not transmit user data traffic. An ECM-enabled 840 may remain in the entry channel for an extended period if "online" communications are not required, or if dSCPC (dynamic Single Carrier Per Channel) resources are unavailable. While idle or waiting in the entry channel, the 840 sends periodic health status messages to the CTOG-250 and Vipersat Management System (VMS) while it continues to service VMS recovery logic timers.

- **Appendix F. ENTRY CHANNEL MODE (ECM) in this manual**
- **Appendix F. ENTRY CHANNEL MODE (ECM) in the Comtech EF Data ODM-840 Outdoor Remote Router / ODMR-840 Reduced Form Factor Outdoor Remote Router Installation and Operation Manual (CEFD P/N MN-ODM840)**
- **Appendix D. ENTRY CHANNEL MODE (ECM) in the Comtech EF Data CDD-880 Multi Receiver Router Installation and Operation Manual (CEFD P/N MN-CDD880)**

Notes:

Appendix B. FEC (FORWARD ERROR CORRECTION) OPTIONS

B.1 FEC Overview

The method of FEC (Forward Error Correction) used by the CDM-840 Remote Router depends on the direction of signal processing in use:

- **The receive (Rx) side** of the CDM-840 operates with error correction based on the DVB-S2 standard for QPSK, 8PSK, 16APSK and 32APSK with concatenated **L**ow **D**ensity **P**arity **C**ode (LDPC) and **B**ose-**C**haudhuri-**H**ocquenghem (BCH).

- **The transmit (Tx) side** of the CDM-840 uses a family of short-block LDPC codes called **VersaFEC®**. VersaFEC is a patents-pending technology wholly owned and developed by Comtech EF Data and CEFD sister division Comtech AHA Corp. (the VersaFEC name is a trademark registered to Comtech AHA). VersaFEC is ideal for lower data rates that demand the shortest possible latency.

B.2 DVB-S2: LDPC and BCH

The DVB-S2 specification defines a generation of performance that boosts throughput by about 30% over DVB-S while using the same amount of bandwidth. The result is coding and modulation that surpasses the capability of concatenated Viterbi and Reed Solomon coding. LDPC and BCH is also a concatenated error correction technique; the LDPC coding scheme features significant, Near-Shannon Bound Performance.

In some cases, LDPC error correction starts flaring toward an error floor as the carrier-to-noise ratio increases. To compensate, BCH error correction follows LDPC and eliminates the flare for any practical range of error rates.

LDPC also functions differently than Viterbi decoding by using iterative decoding. In this process, the data initially corrected by the LDPC decoder is re-encoded and run through the decoder again to correct additional errors. Through soft decision output from the LDPC decoder and a high-speed processor operating at a rate much higher than the data rate, the iterative process is run as many times as possible before corrected data is finally output to make way for a new block of data entering the decoder.

LDPC also uses interleaving to spread the errors. In contrast, Viterbi error correction operates by passing data through the convolutional error correction process using a single error correction pass.

The error correcting capability of LDPC is enhanced by use of large block sizes. Although large block sizes can increase latency in low bitrate applications (typically less than 2Mbps), this is not a drawback in one-way broadcast applications. Links with LDPC normally operate at multi-megabit data rates where latency effects are minimal. The standard block size for LDPC is 64,800 bits and, for lower data rate applications, a short frame block at 16,800 bits suffers only a small error correcting loss (0.2 to 0.5 dB) compared to the standard block.

B.2.1 Range of Data Rates

See* Sect. 1.4 SUMMARY OF SPECIFICATIONS *for the range of available data rates.

B.2.2 BER, QEF, Eb/No, Es/No Spectral Efficiency, and Occupied Bandwidth

Depending on the operating mode, the DVB standard uses different modes of specifying performance with a unit in IF Loop and Additive White Gaussian Noise (AWGN):

- **DVB-S2 standard: "Quasi Error Free" (QEF)** is defined as "less than one uncorrected error-event per transmission hour at the level of a 5 Mbits/s single TV service decoder", approximately corresponding to a Transport Stream Packet Error Ratio equal to a PER<10^{-7} before demultiplexer. A packet is defined as block of 188-byte MPEG frame size data.

- **Es/No vs. Eb/No:** The DVB-S2 standard commonly refers to the use of Es/No instead of Eb/No. When links operate at a constant symbol rate this is a good method for comparing the performance of different modulation types and code rates.

  The relation between the two quantities is given by:

$$\mathbf{Eb/No = Es/No - 10_{log}(Spectral\ Efficiency)}$$

- **Occupied Bandwidth:** Occupied bandwidth is defined as the bandwidth between -10 dB points of the power spectral density, which are approximately:

  Occupied Bandwidth = 1.19 x Symbol Rate, for 35% Rolloff
  = 1.15 x Symbol Rate, for 25% Rolloff
  = 1.12 x Symbol Rate, for 20% Rolloff

* Taken at the -10 dB points on the plot of power spectral density, the occupied bandwidth is 1.19 x Symbol Rate for 35%, and 1.15 x Symbol Rate for 25%.

B.3 VersaFEC (Short-block LDPC)

While LDPC coding represents a significant development in the area of FEC and its performance is exceptional in terms of coding gain, its higher latency is considered disadvantageous in some applications.

Comtech EF Data's development of LDPC incorporated research into ways to reduce the block size of LDPC (and hence its latency) while preserving the coding gain performance very close to the Shannon bound. The result is development of a set of VersaFEC codes with two distinct purposes:

1) To provide an expanded choice of combinations of modulation and coding that ***significantly*** reduces latency without compromising coding gain performance.

2) To provide combinations of modulation and coding (***MODCODs***), which are suitable for not only Constant Coding and Modulation (**CCM**) applications, but are also the basis for a patent-pending Adaptive Coding and Modulation (**ACM**) system.

VersaFEC offers a sufficient range of code rates and modulation types that optimize link performance under most conditions. **Figure B-1** compares the performance of the VersaFEC codes with the Shannon bound. Note that the chart uses *SNR* in place of *Eb/No* – a convention for comparing ACM MODCODs. SNR is defined as **Eb/No + 10_{log} (Spectral Efficiency)**.

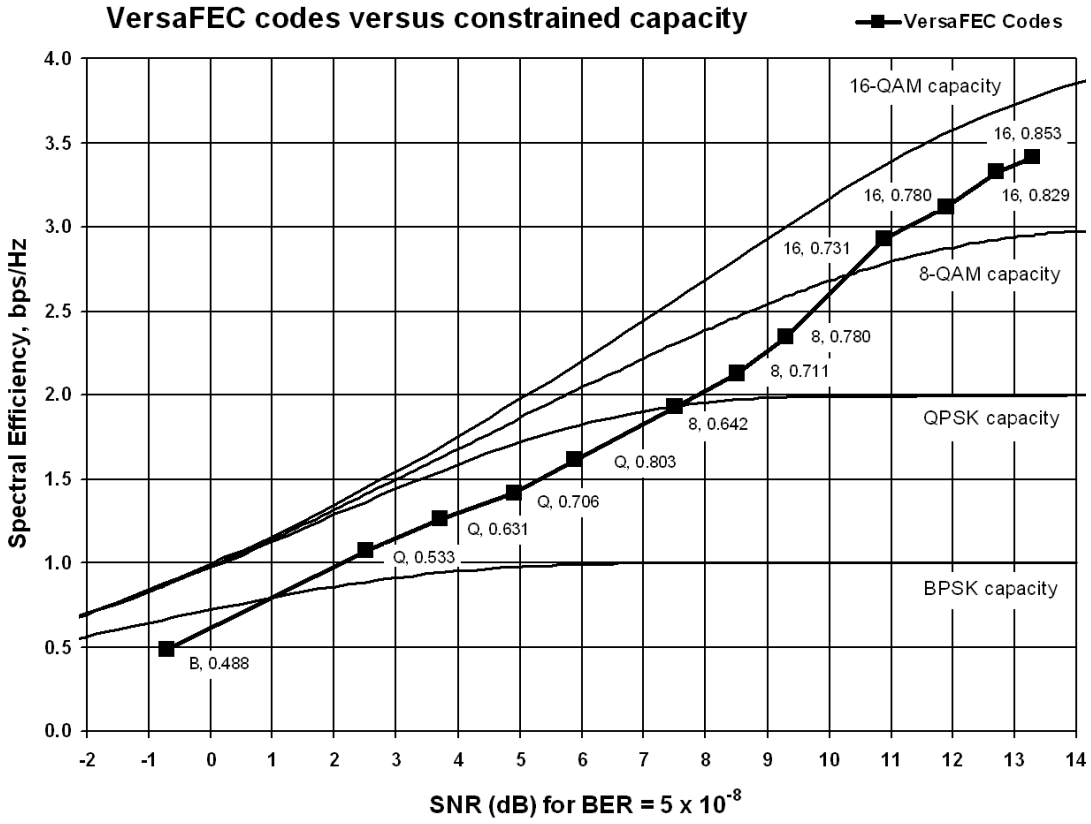


Figure B-1. The VersaFEC Codes versus Shannon Capacity

Table B-1 specifies the 12 modulations types / code rates that comprise the VersaFEC MODCOD Set. These chosen modulation types (BPSK, QPSK, 8-QAM and 16-QAM) and code rates afford a continuous progression of performance in terms of both Eb/No and spectral efficiency – essential aspects of a well-engineered ACM system.

Table B-1. The VersaFEC MODCOD Set

Modulation	Code Rate	Spectral Efficiency, bps/Hz	Block size, bits	Typical Eb/No, for BER = 5 x 10^{-8}	Latency at 64 kbps, in milliseconds	Min. Data Rate, CCM mode	Max. Data Rate, CCM mode
BPSK	0.488	0.49	2k	2.4 dB	26	16 kbps	2.19 Mbps
QPSK	0.533	1.07	4.1k	2.2 dB	53	18 kbps	4.80 Mbps
QPSK	0.631	1.26	4.1k	2.7 dB	59	21 kbps	5.67 Mbps
QPSK	0.706	1.41	4.1k	3.4 dB	62	23 kbps	6.34 Mbps
QPSK	0.803	1.61	4.1k	3.8 dB	66	26 kbps	7.22 Mbps
8-QAM	0.642	1.93	6.1k	4.6 dB	89	31 kbps	8.67 Mbps
8-QAM	0.711	2.13	6.1k	5.2 dB	93	35 kbps	9.60 Mbps
8-QAM	0.780	2.34	6.1k	5.6 dB	97	38 kbps	10.53 Mbps
16-QAM	0.731	2.93	8.2k	6.3 dB	125	47 kbps	13.16 Mbps
16-QAM	0.780	3.12	8.2k	7.0 dB	129	50 kbps	14.04 Mbps
16-QAM	0.829	3.32	8.2k	7.5 dB	131	54 kbps	14.91 Mbps
16-QAM	0.853	3.41	8.2k	8.0 dB	132	55 kbps	15.35 Mbps

B.3.1 Range of Data Rates

See* Sect. 1.4 SUMMARY OF SPECIFICATIONS *for the range of available data rates.

B.4 CDM-840 Rx/Tx Error Performance Characteristics

For Rx DVB-S2 Operation: Figure B-2 through **Figure B-5** illustrate the guaranteed error performance characteristics of the CDM-840 while receiving with Normal frames (64,800 bits), Pilots ON.

For Tx VersaFEC Operation: Figure B-6 through **Figure B-9** illustrate the guaranteed error performance characteristics of the CDM-840.

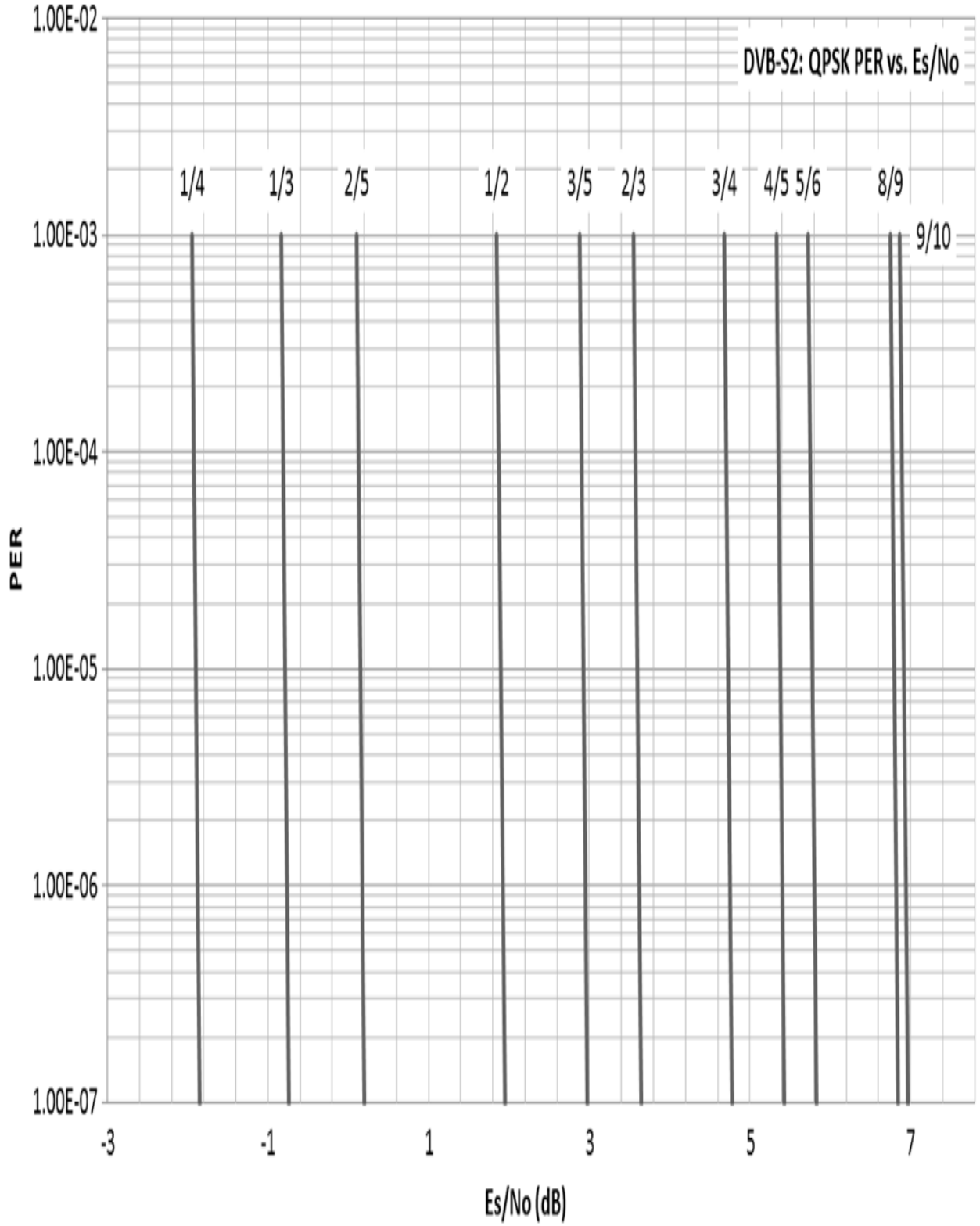


Figure B-2. DVB-S2 QPSK Packet Error Rate versus Es/No

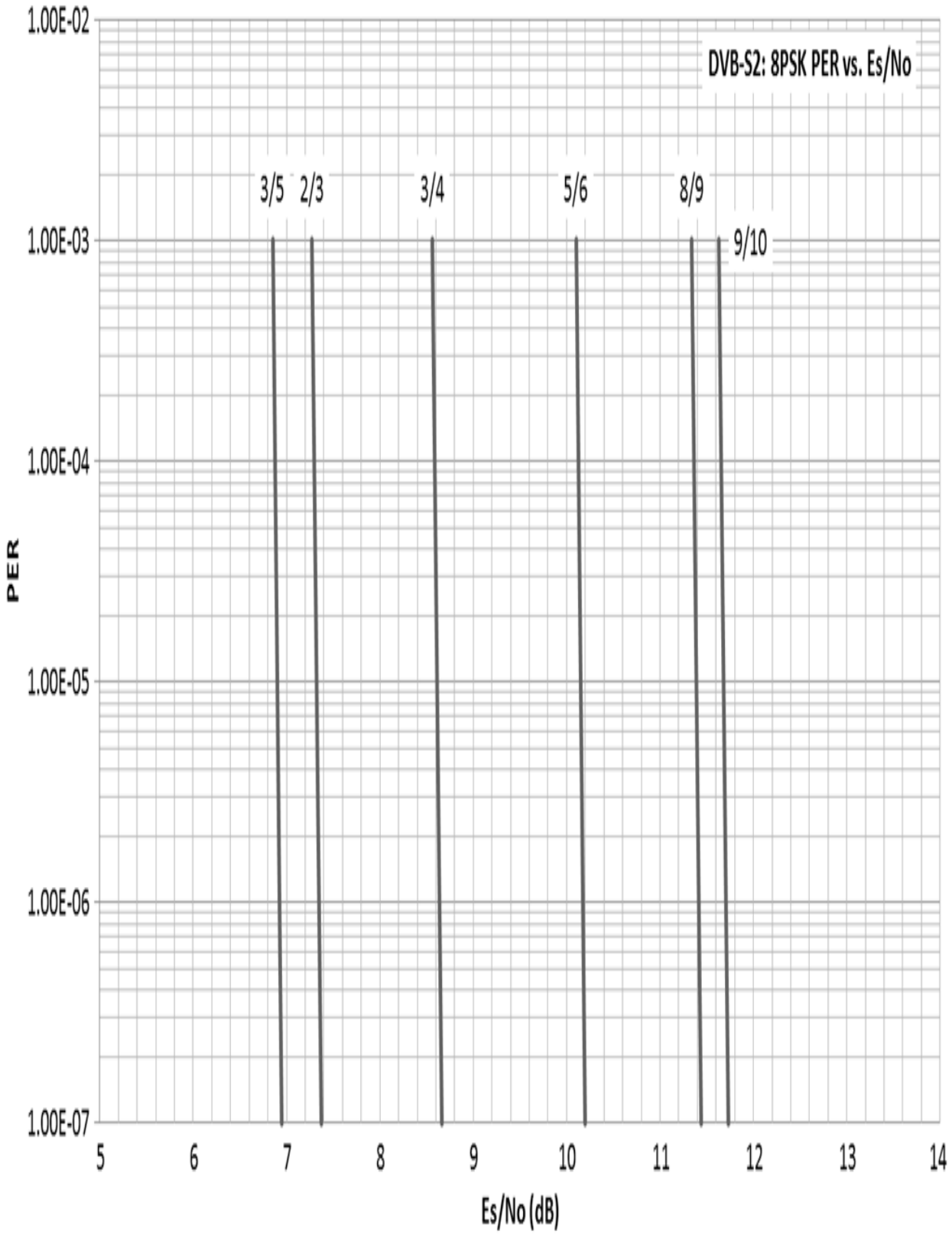


Figure B-3. DVB-S2 8PSK Packet Error Rate versus Es/No

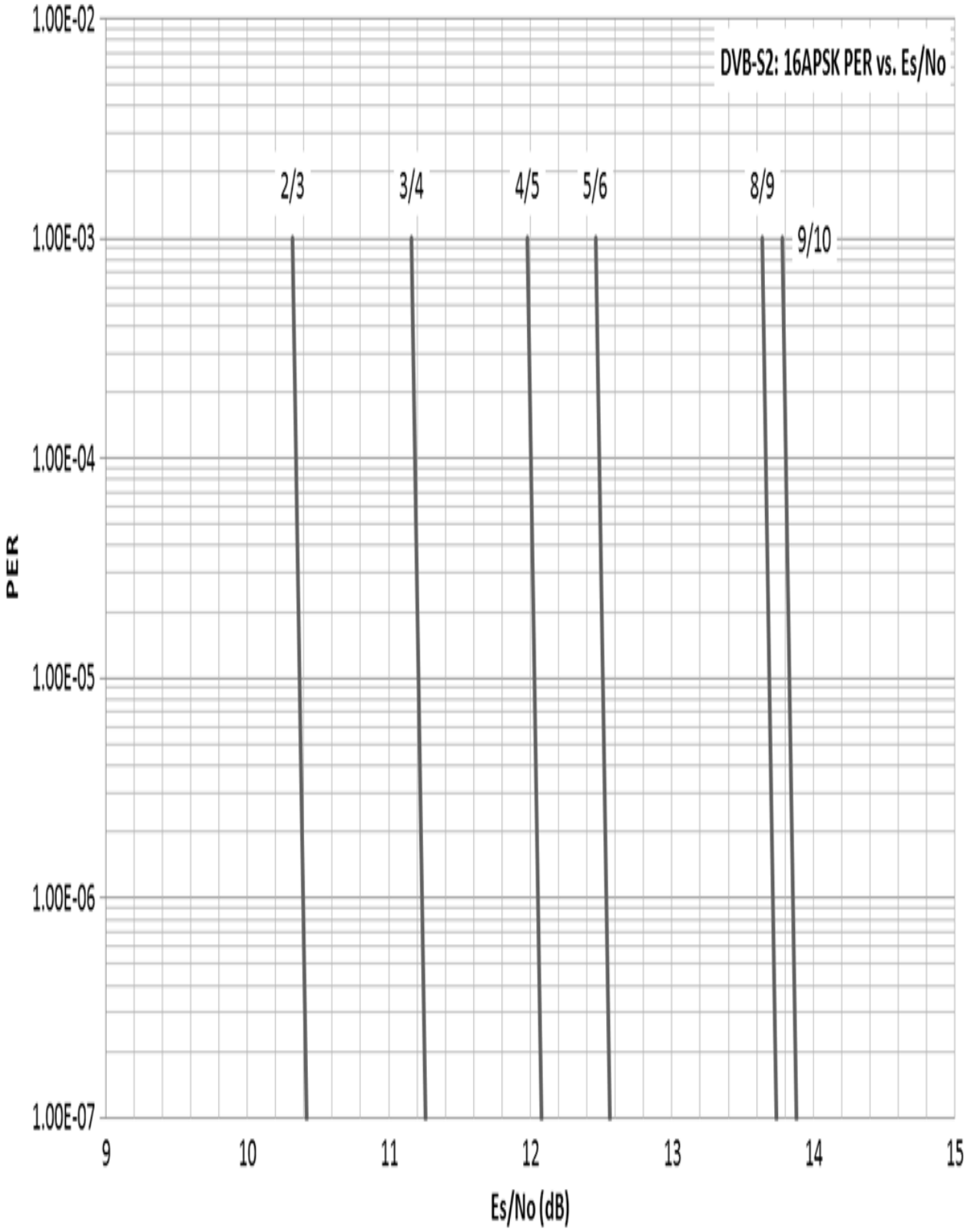


Figure B-4. DVB-S2 16APSK Packet Error Rate versus Es/No

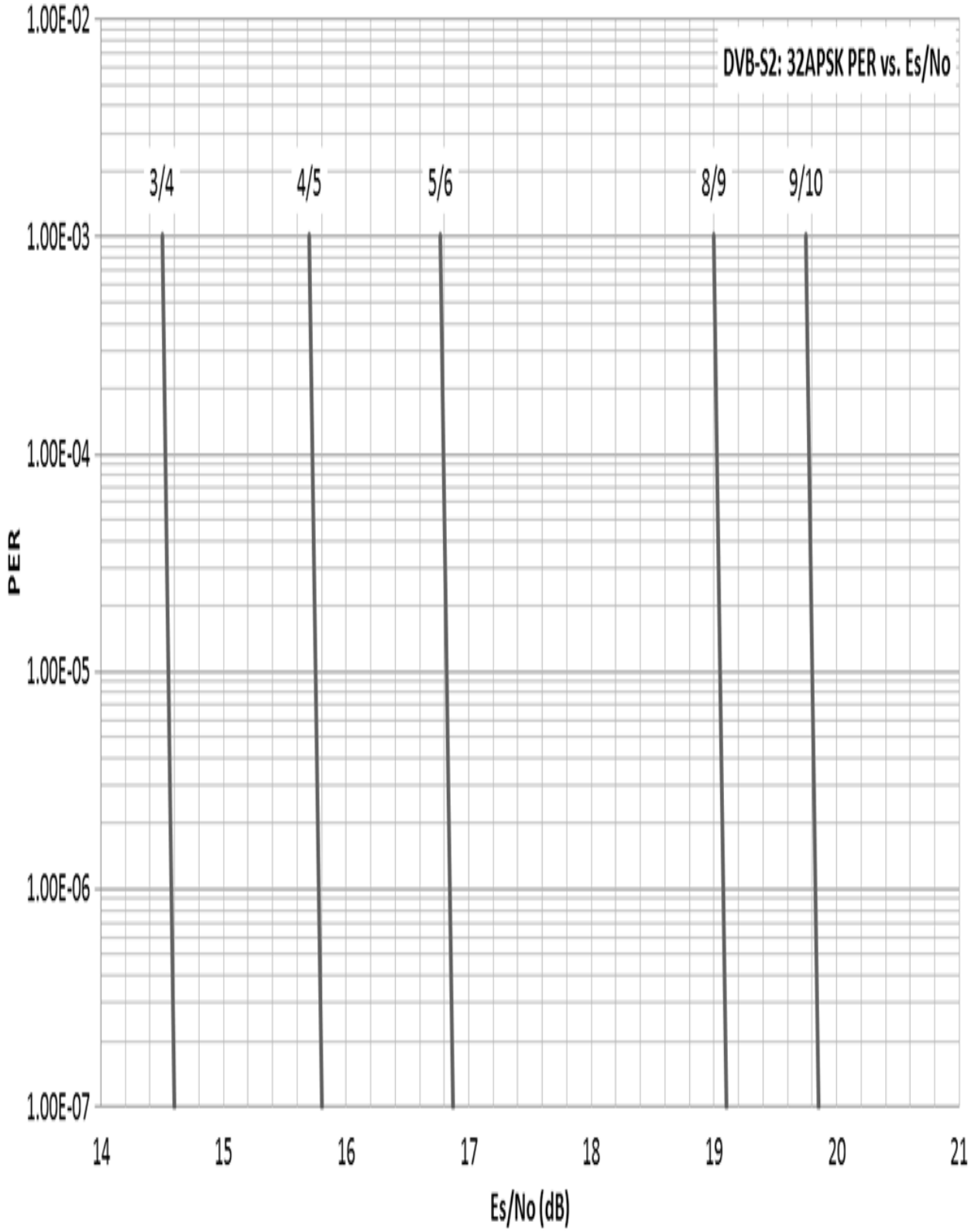


Figure B-5. DVB-S2 32APSK Packet Error Rate versus Es/No

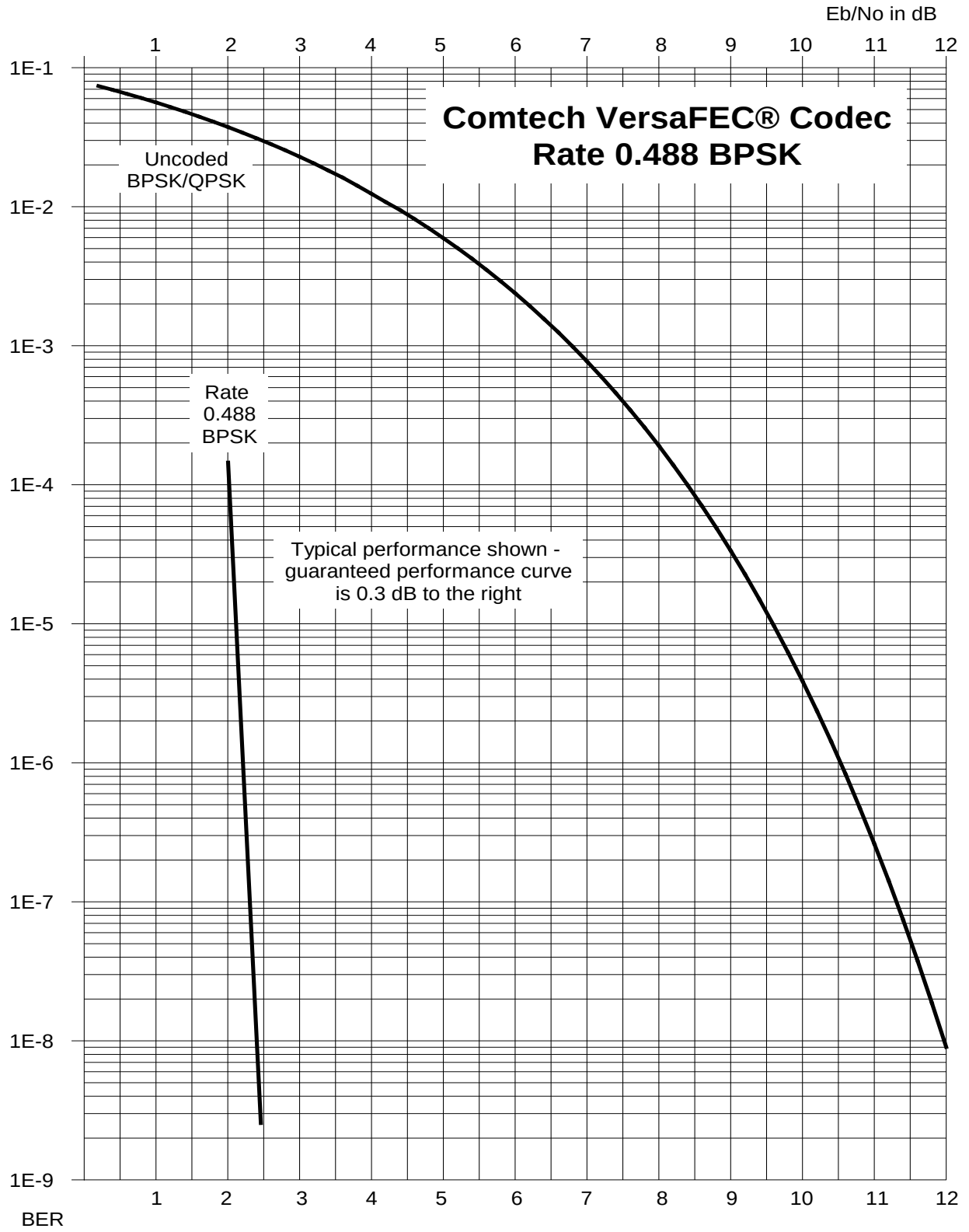


Figure B-6. VersaFEC Codec – BPSK, Rate 0.488

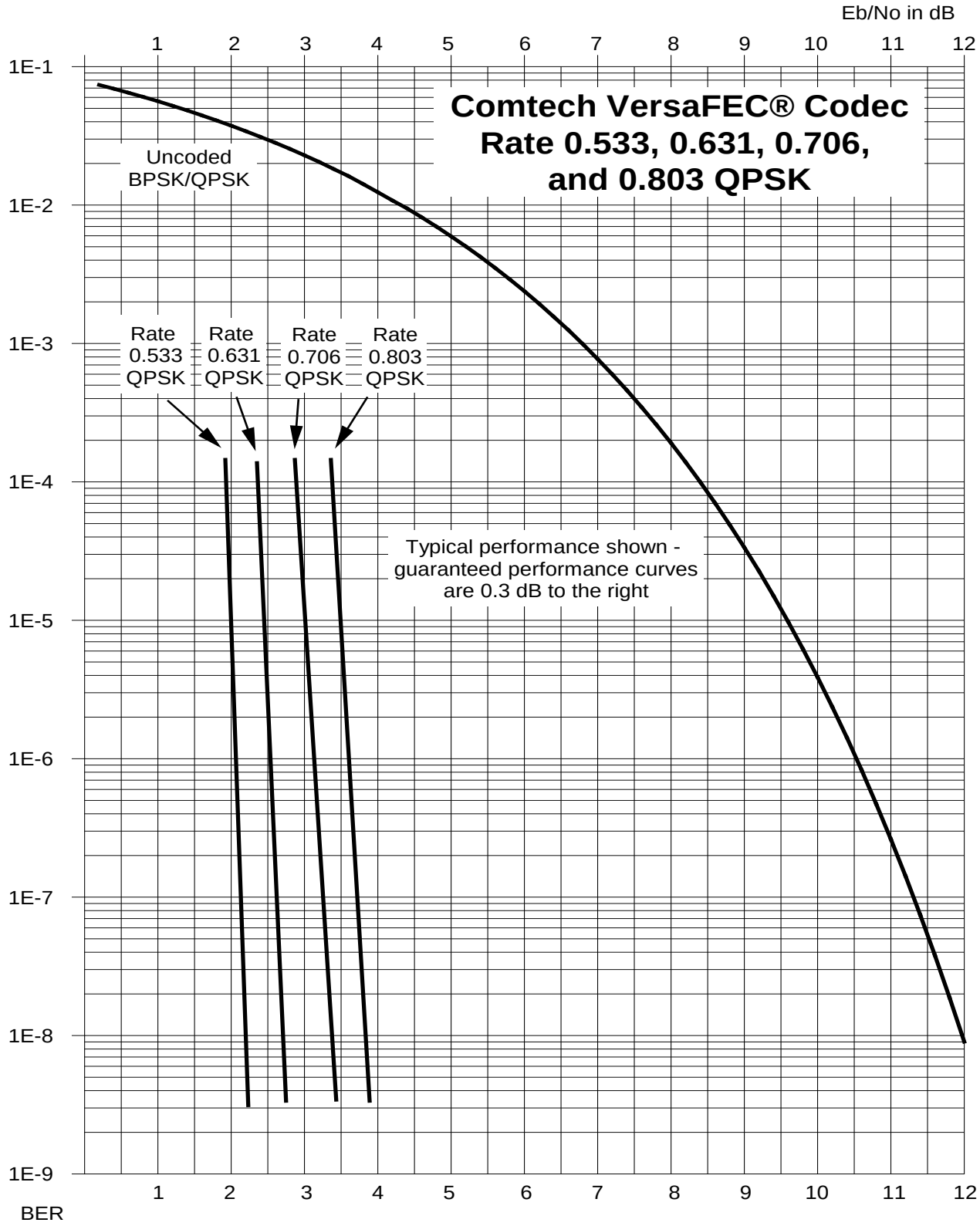


Figure B-7. VersaFEC Codec – QPSK, Rate 0.533, 0.631, 0.706 and 0.803

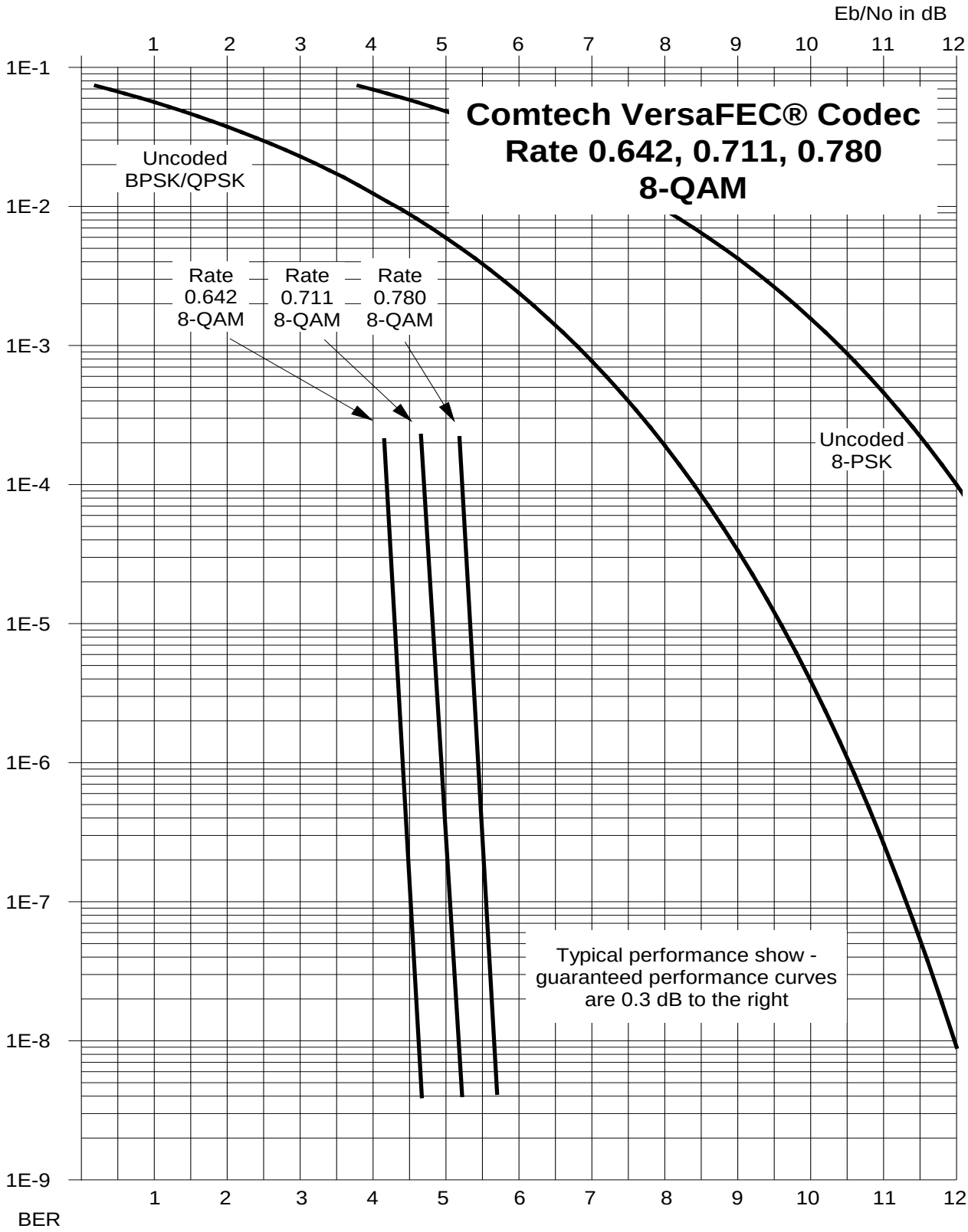


Figure B-8. VersaFEC Codec – 8-QAM, Rate 0.642, 0.711, and 0.780

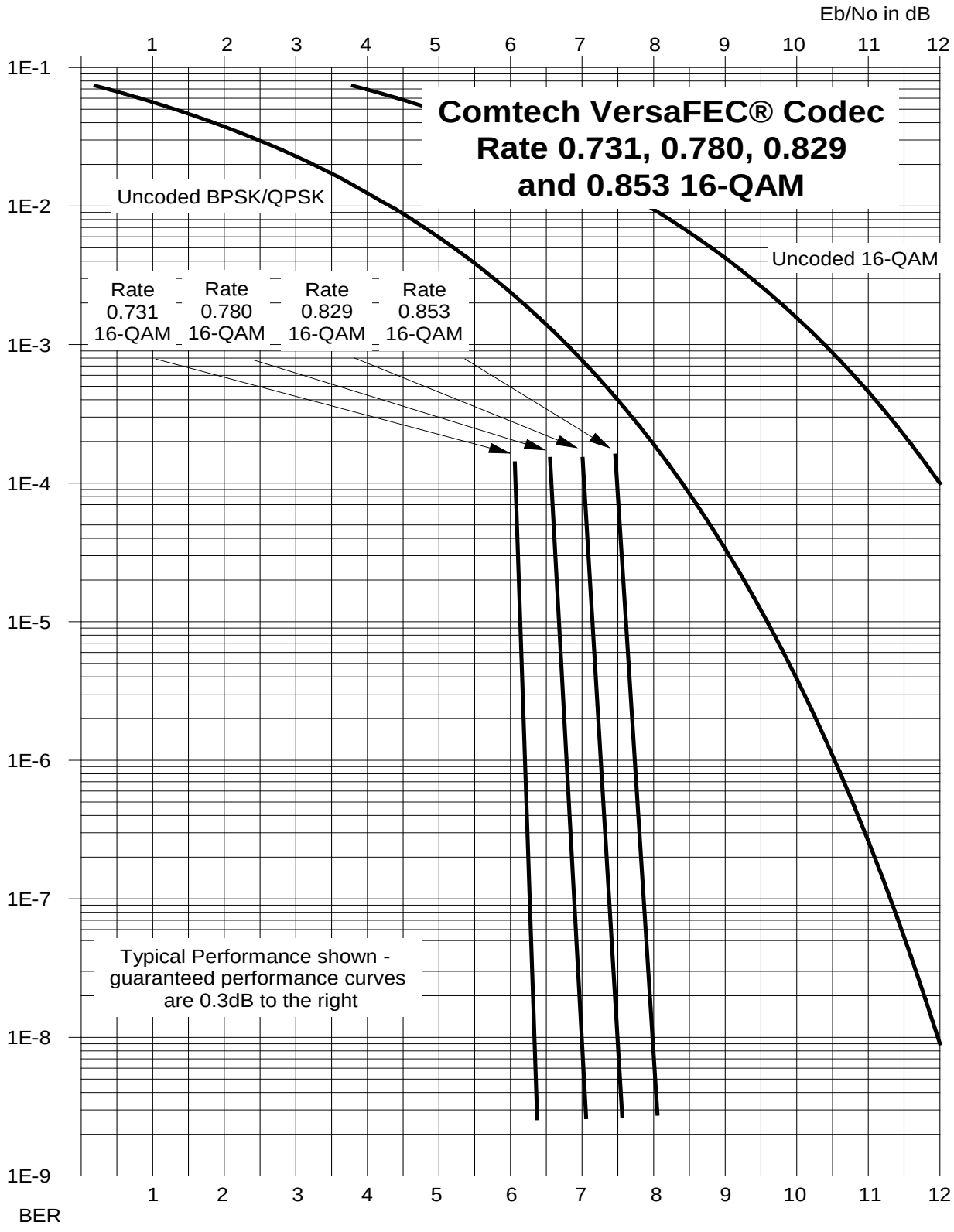


Figure B-9. VersaFEC Codec – 16-QAM, Rate 0.731, 0.780, 0.829 and 0.85

Appendix C. BRIDGE POINT-TO-MULTIPOINT (BPM) OPERATION

C.1 Introduction

The overall intent of the Advanced VSAT Bridge Point-to-Multipoint (BPM) feature is to make the Advanced VSAT equipment appear as a "Sky Ethernet Switch". This allows for a greatly simplified network deployment.

In BPM Mode, all L2/L3/L4 protocols, such as VLAN, MPLS, IPv6, OSPF, and BGP, flow through the network as they would through an off-the-shelf Ethernet Switch.

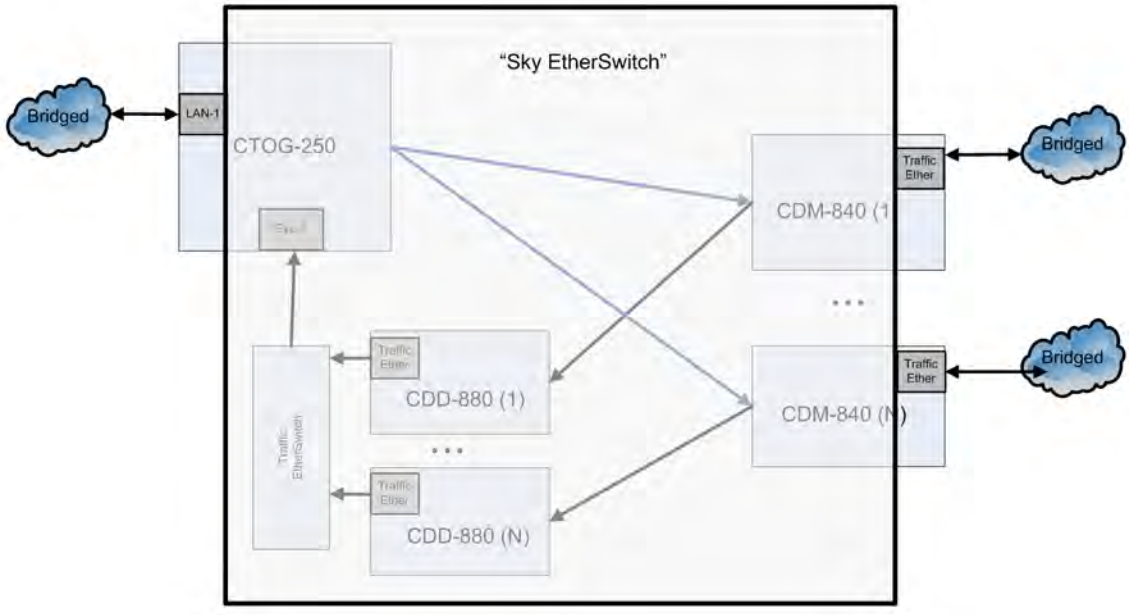


Figure C-1. Advanced VSAT BPM "Sky Ethernet Switch"

C.2 Supported Network Configurations

When running in BPM Mode, the Advanced VSAT System supports Flat Networks, Flat Networks with Routers, and VLAN Trunking network topologies.

C.2.1 Flat Network

In a Flat Network (**Figure C-2**), all devices are on the same IP subnet. This is a very easy-to-use topology for simple and/or small networks.

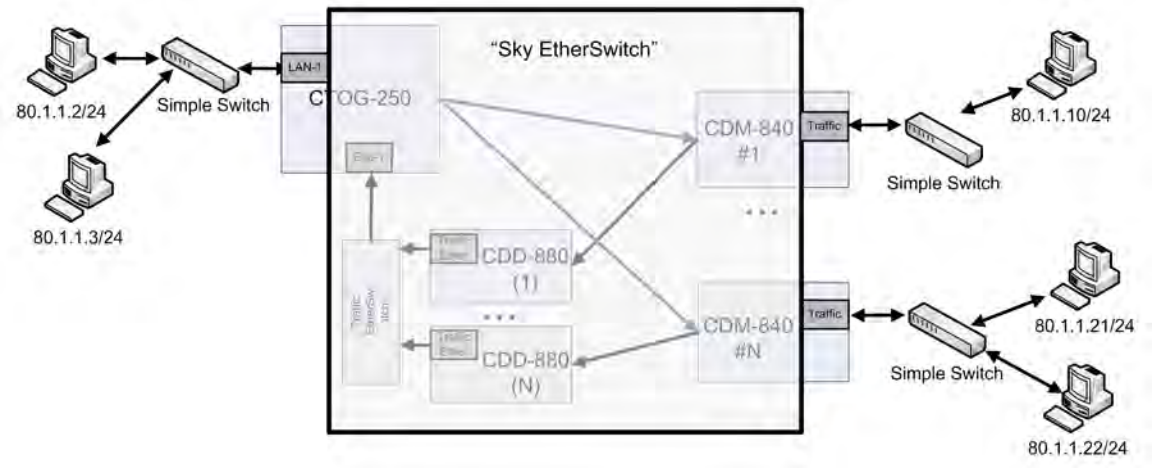


Figure C-2. Flat Network

C.2.2 Flat Network with Routers

This variation of the Flat Network includes Routers at each site. With this topology (**Figure C-3**), the Routers can be placed on the same subnet as if they were connected to the same Ethernet Switch, and all core routing protocols such as OSPF, RIPv2, BGP, VRRP, etc. work as expected.

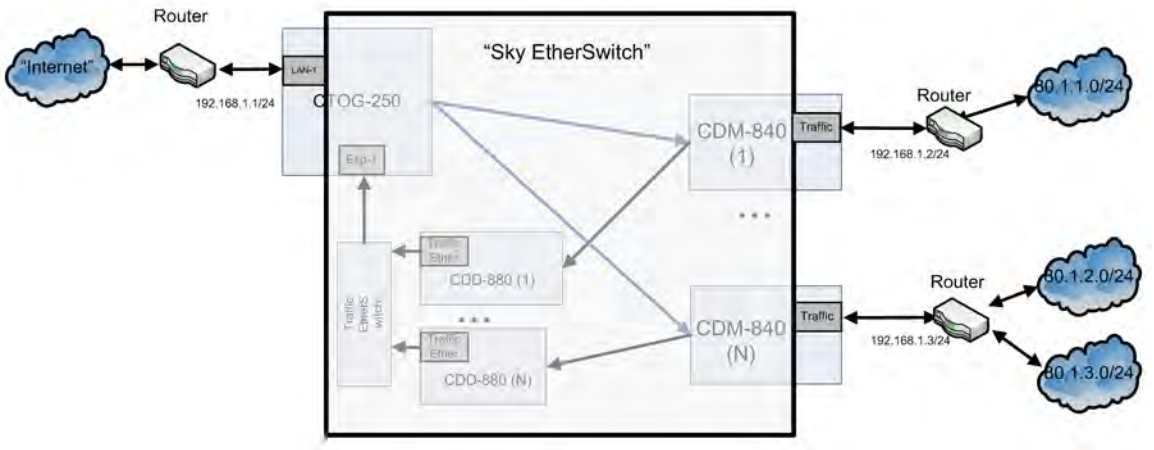


Figure C-3. Flat Network with Routers

C.2.3 VLAN Trunking

In a VLAN Trunking topology (Figure C-4), the Hub side equipment functions as a VLAN trunking interface. You can map Outbound packets (Hub to Remote) to the desired QoS Group (see **Sect. C.6**).

By default, the CDM-840 equipment functions as a VLAN trunk and passes all traffic received on the WAN and Traffic LAN ports. In this mode, you should have a VLAN-enabled Ethernet Switch at each remote to properly break out the VLAN into the desired network topology.

In addition, you can optionally configure the CDM-840 in Access Mode with a user assigned VLAN ID (see **Sect. C.4**).

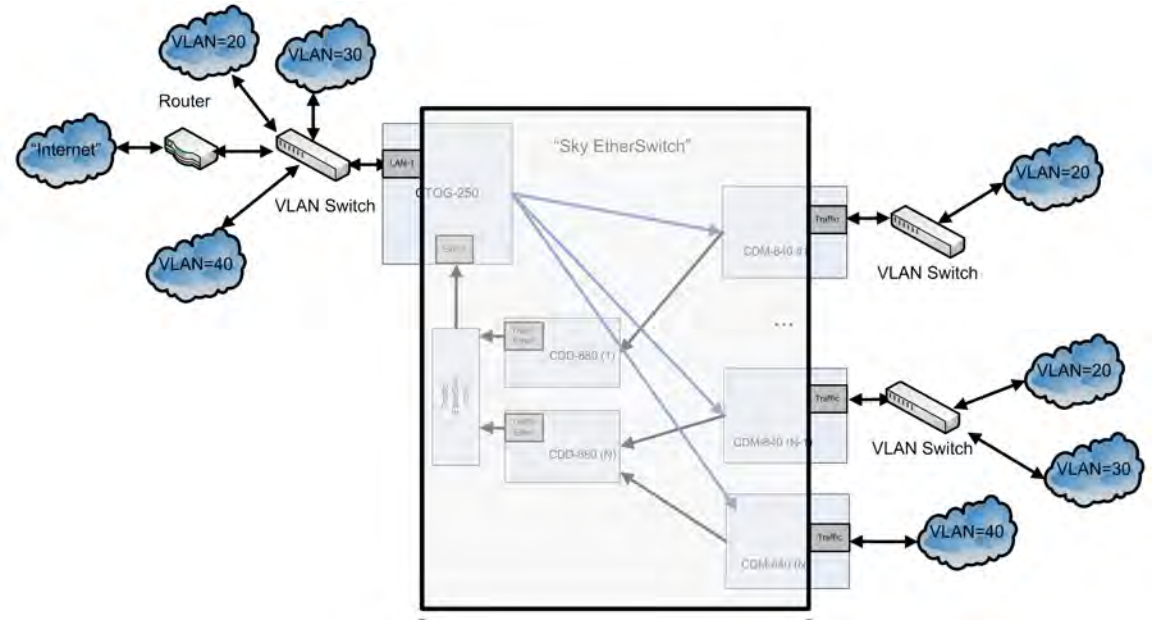


Figure C-4. BPM with VLANs

C.3 Packet Processing

C.3.1 Traffic Network / Ethernet Switch Behavior

The Advanced VSAT BPM feature functions as a Learning Ethernet Switch when you set the "Working Mode" to BPM. BPM has the following basic functionality:

- MAC addresses associated with each segment/port are learned by inspecting the source MAC for packets arriving at each Ethernet port.
- Once the port association for a MAC address is learned, an Ethernet Switch will not transmit Ethernet packets with that MAC address to other segments/ports.
- Broadcast packets are sent out all interfaces.

For Advanced VSAT BPM Mode, it is important to note that the CTOG-250 Comtech Traffic Optimization Gateway and CDM-840s learn MAC addresses and avoid any unnecessary transmission. In BPM Mode, the CDD-880 Multi Receiver Router functions as a receive-only pass-through to the CTOG-250.

C.3.2 Management Network

Note that, while the Advanced VSAT BPM feature supports Bridged Traffic ports, the Management ports for all units in the Advanced VSAT System must operate in Router Mode.

When in BPM Mode, the Traffic ports on the Advanced VSAT units do not have IP Addresses (as you would expect from an Ethernet Switch). Therefore, the units cannot be managed (SNMP, Web, Telnet) or pinged from this interface.

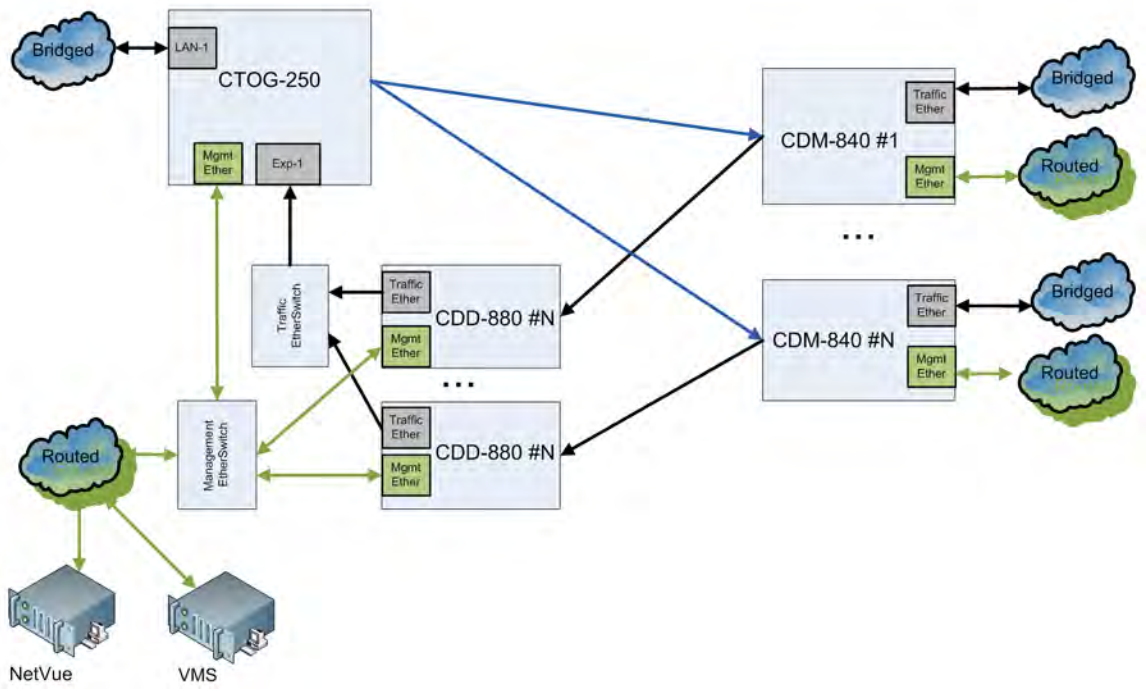


Figure C-5. Management Network in BPM Mode

When configuring the CTOG-250 for "BPM" Working Mode, Comtech Dynamic Routing Protocol (CDRP) continues to work as expected to populate the CTOG-250 with the routes required to manage the remote CDM-840s via their Management IP Addresses. Handle the Return Link Routed Management Traffic by entering a default route (0.0.0.0/0 "toWAN") in the CDM-840's routing table.

As with "Router" Working Mode, you must enable CDRP in order for ACM/VCM on the DVB-S2 Outbound Carrier to work for Management Traffic destined to each remote.

User traffic on the Traffic ports does not require CDRP, as BPM automatically and seamlessly handles ACM/VCM for this traffic.

When operating the network with the Comtech NetVue or Vipersat Management System (VMS), the Advanced VSAT units (CTOG-250/CDM-800, CDM-840, and CDD-880) are managed through the Management Network using the Management Ethernet port and Management IP Addresses.

C.4 IEEE 802.1Q Support

Advanced VSAT support for IEEE 802.1Q includes VLAN Trunking, Access Mode and Multiple VLAN Tagging support.

C.4.1 VLAN Trunking

The Advanced VSAT Hub equipment always functions in VLAN Trunking Mode. Trunking Mode means that Ethernet packets received by the CTOG-250 LAN-1 interface are passed, unchanged and unfiltered, to the appropriate remote modem.

Likewise, when the CDM-840 is in Trunking Mode, the VLAN tags are passed, unchanged and unfiltered, through the modem.

The CDD-880 is a receive-only pass-through in BPM Mode. As such, it receives the packets from the remotes and passes them to the CTOG-250 for processing and forwarding.

C.4.2 Access Mode Support

As part of 802.1Q support, the CDM-840 supports Traffic port configuration in either Trunk or Access Mode. Access Mode allows the CDM-840 to function as a VLAN edge switch to add and remove VLAN tags to connect a distant end network with other networks.

- All packets received at the Traffic Ethernet port are tagged with the assigned Access Port VLAN ID.
- All packets having the matching VLAN ID that are then received from the WAN have the VLAN tag removed, and the packets are passed out the Traffic LAN port.
- In Access Mode, the CDM-840 drops all packets that already have VLAN tags that it receives at its Traffic LAN port.
- In Access Port Mode, packets that do not have a matching VLAN ID that are received from the WAN are dropped.

  (Note that this is not normal behavior as, once the MAC addresses have been learned at a given remote, all other remotes will then perform a hardware-level filter on the packets.)

C.4.3 Multiple VLAN Tagging Support

The Advanced VSAT platform supports processing Ethernet packets with multiple stacked VLAN tags, with the following limitations:

- At the CTOG-250, only the outermost VLAN ID is used for mapping to the appropriate QoS Groups.

- In Trunking Mode, L2 Header Compression only compresses packets with one or two VLAN Headers. Packets with more than two VLAN Headers are allowed to pass, but only the first two VLAN headers will not be compressed.

C.5 Multicast BPM Behavior

In BPM Mode, Multicast packets are forwarded in two directions:

- **Outbound Path (CTOG-250 ► CDM-840):** Multicast packets arriving at the CTOG-250 are passed out the WAN to all CDM-840s using the "VCM Only MODCOD" option for the matching QoS Group (based upon VLAN or Subnet).

- **Return Link Path (CDM-840 ► CDD-880 ► CTOG-250):** Multicast packets arriving into the CDM-840 Traffic port are automatically passed out the CTOG-250's Traffic port only. Internet Control messages (such as OSPF, RIP, and BGP) that fall into the 224.0.0.0 - 224.0.1.255 address range are automatically passed out both the CTOG-250's LAN and WAN ports.

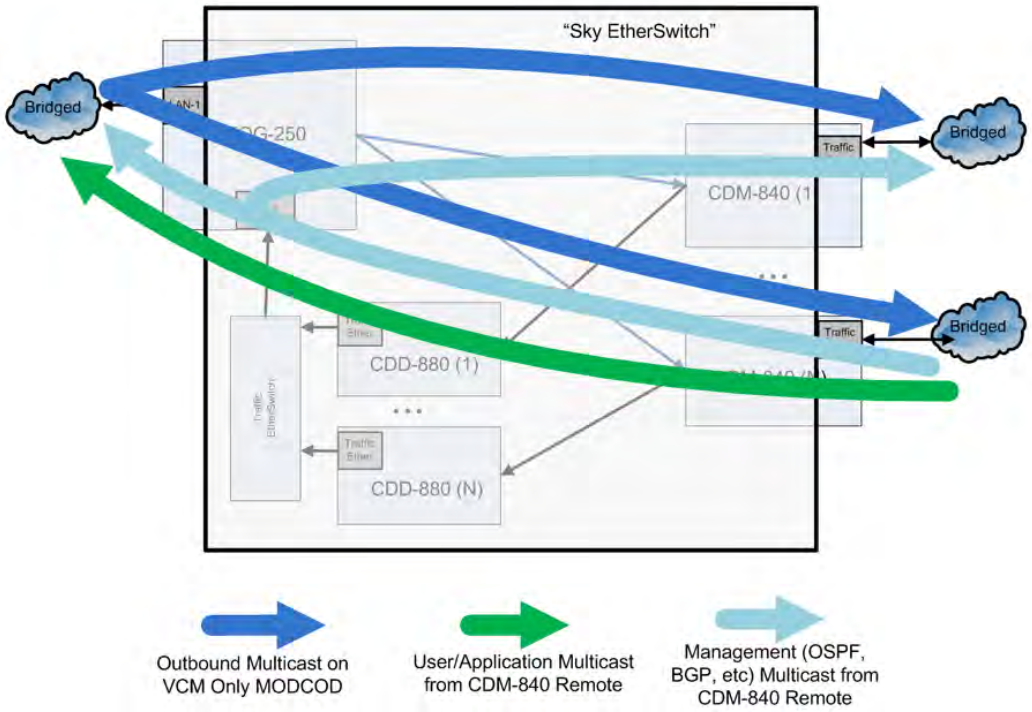


Figure C-6. Multicast Behavior in BPM Mode

If required, you can create QoS rules with "Filter All" enabled to filter undesired Multicast from traversing the satellite network for both the CTOG-250 and the CDM-840.

C.5.1 Multicast Management/Routed Behavior (no change)

In both BPM and Router Modes, Multicast packets arriving at the Management (routed) port of the CTOG-250 and CDM-840 must be configured to be transmitted to the WAN by adding a Multicast-specific route table entry with a "/32" subnet.

Packets arriving at the CDM-840 downlink pass out the CDM-840 Ethernet port based upon the following criteria (configurable via NetVue or the Web page for each CDM-840):

- **Downlink (outbound from the Hub Segment) Multicast All –** All downlink outbound Multicast packets pass to the Traffic LAN interface of the CDM-840 unit.

- **Use IGMP (Internet Group Management Protocol)** – Only remotes that have IGMP clients enabled with the Multicast address pass the Multicast packet to the CDM-840's LAN port.

C.6 BPM and Group QoS with Outbound ACM/VCM

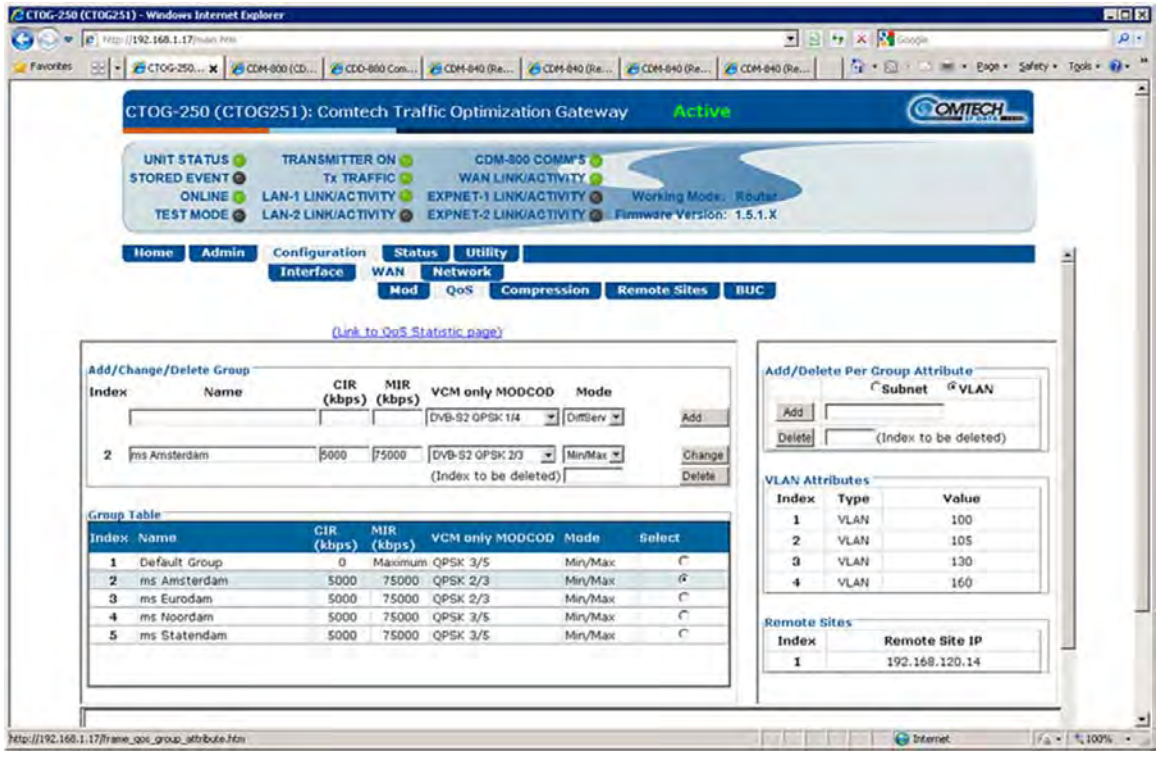


Figure C-7. Configuring VLAN to QoS Group Mapping

ACM/VCM on the Outbound carrier works with BPM by seamlessly matching packets to the correct remote site. While no configuration is required, you have the ability to first use a VLAN

ID, and then use a Subnet/Mask, to associate a packet to a QoS Group. This functionality allows you to partition the Outbound Carrier capacity.

In BPM Mode, you must define a simple VLAN mapping algorithm to map traffic for a given remote to a single QoS Group and a single VLAN ID.

However, in cases where it is desired to the support the same VLAN ID across multiple remotes but continue to map the traffic for a remote to a single QoS Group, you have the ability to assign the same VLAN with different subnet/masks.

Once you add a QoS Group, you can add up to 32 VLAN tags and/or 32 Subnet/Masks per QoS Group.

Packet-to-QoS Group mapping employs a strict hierarchical matching algorithm:

Incoming Packet	Matching criteria
No VLAN header	Uses the Destination IP Address of the packet to match the packet to the QoS Group with the user configured Subnet/Mask. The desired QoS Group must not have any VLAN tags.
1 VLAN Tag	First match on the QoS Group with the configured VLAN tag. If more than one QoS Group has the packet's VLAN ID, then the QoS Group with the matching Subnet/Mask will be used. QoS Groups with a different VLAN ID or no VLAN IDs will not be matched.
2 VLAN Tags	Same as the 1 VLAN Tag case, but the outermost VLAN tag will be used for matching purposes.

If the packet fails to match on any of the User Configured QoS Groups, the packet is placed into the Default QoS Group for processing.

C.7 Hub Network Configuration

In order for the BPM feature to operate as expected, you must configure the Hub Network as defined here.

A standard off-the-shelf Ethernet switch that supports port isolation and MAC learning is required. All ports connected to the CEFD equipment should have MAC learning enabled.

There are three basic deployment approaches:

1) A standalone CTOG-250

2) Multiple independent CTOG-250s

3) CTOG-250 redundancy.

For the standalone CTOG-250 approach, there are no restrictions on the Hub network beyond requiring that you connect the traffic ports for all of the CDD-880s and the CTOG-250 to the same Ethernet Switch.

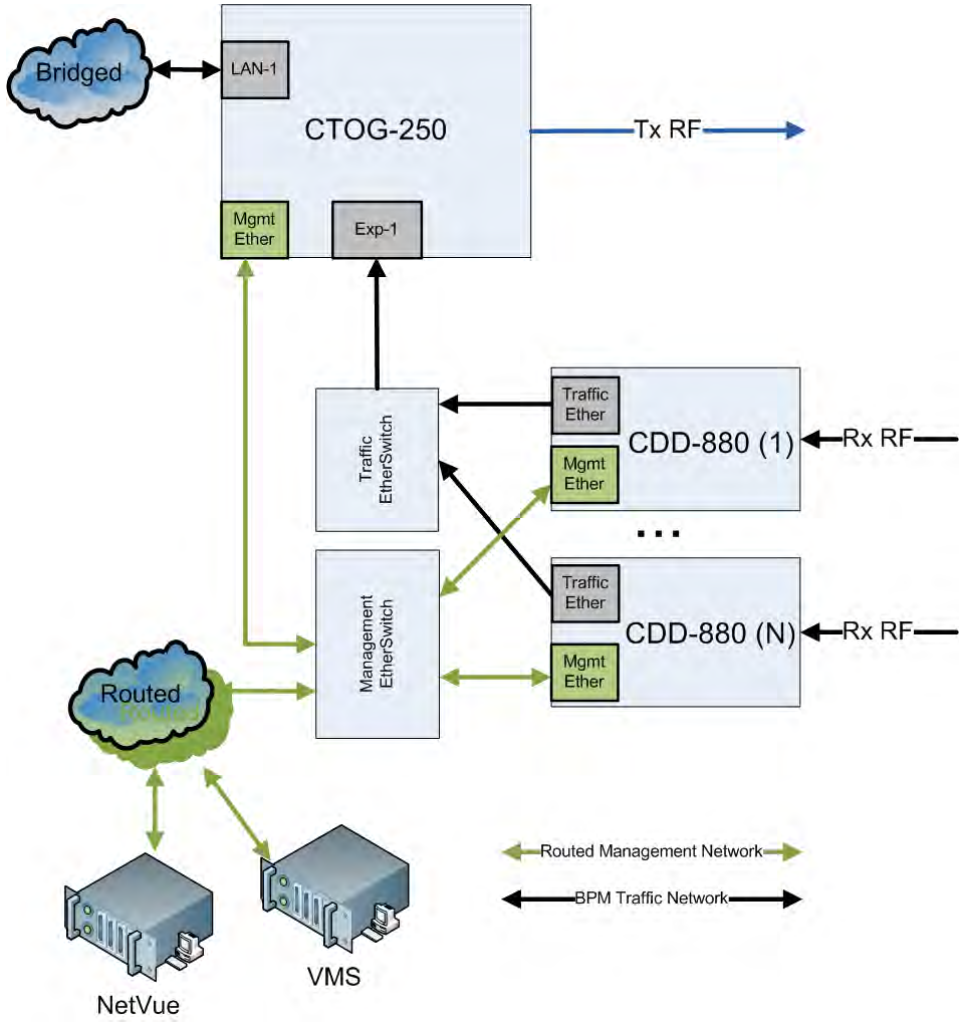


Figure C-8. Hub Configuration – Standalone CTOG-250, No Redundancy

While the **Figure C-8** diagram suggests inclusion of the management network portion, it is not strictly required. However, what ***is*** strictly required is that the following holds true for all Advanced VSAT deployments:

- The Management IP Addresses for all units have IP connectivity to the NetVue and VMS server's IP Address.
- CDM-880 management ports must have a packet path to the Management IP Address of the CDM-840s.
- CDM-840s have a packet path to the Management IP Address of the CTOG-250.

If you have multiple Advanced VSAT outbound carriers at a single Hub, Comtech EF Data recommends the deployment architecture shown in **Figure C-9**.

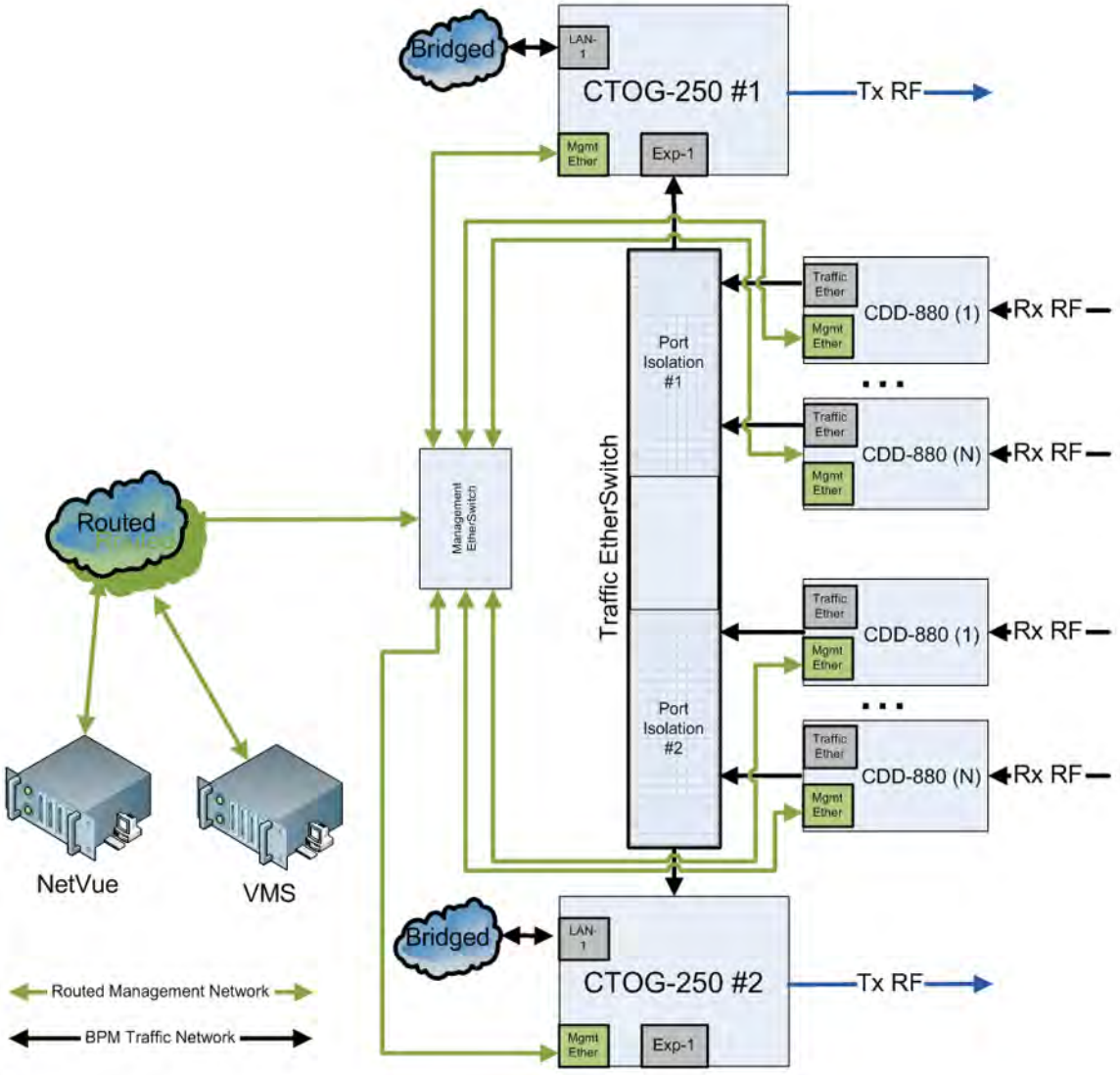


Figure C-9. Hub Network Configuration

If you have multiple Advanced VSAT outbound carriers at a single Hub, Comtech EF Data recommends the deployment architecture shown in **Figure C-10**. In this case, there is no need for port isolation for each of the respective outbound networks; however, you **MUST** configure the "Static CTOG-250 IP" that is found on the CDD-880 **Configuration | Network | BPM** web page.

Once you set this value, then the CDD-880 is automatically associated with the desired CTOG-250. The CDD-880 and CTOG-250 exchange a proprietary handshake mechanism that

allows the packets coming from the CDD-880s to be associated with the correct CTOG-250, as long as you enable MAC learning on the attached Ethernet Switch.

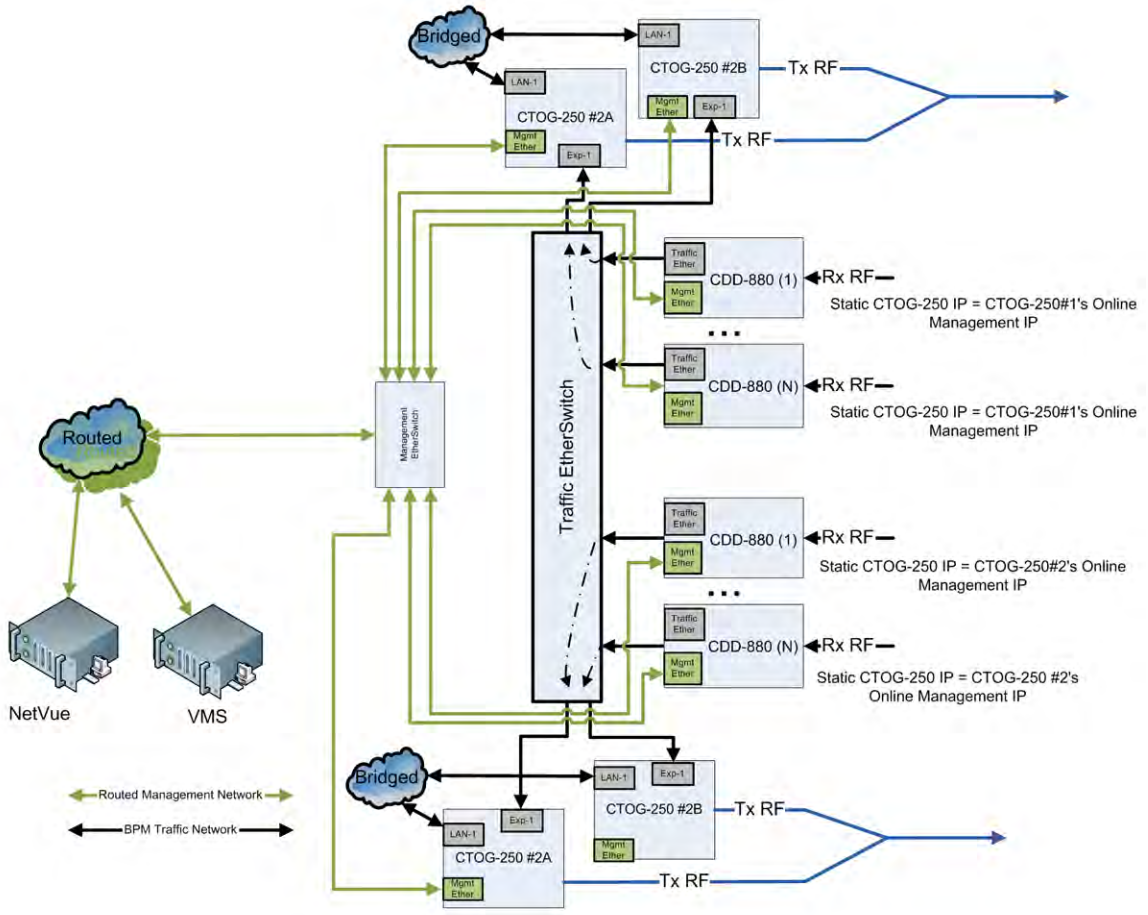


Figure C-10. Multiple CTOG-250 Outbounds in Redundant Mode

C.8 Compatible Features and Detailed Specifications

Advanced VSAT BPM Mode is compatible with the following features:

Feature	Comments
Group QoS (CTOG-250) and QoS (CDM-840)	
Header Compression	Includes the following L2 Protocols: • Ethernet 2.0 • Ethernet 2.0 + VLAN-tag • Ethernet 2. 0 + V LAN-tag + VLAN-tag • Ethernet 2.0 + MPLS • 802.3-raw • 802.3-raw + VLAN-tag • 802.3-raw + VLAN-tag + VLAN-tag • 802.3 +802.2 • 802.3 +802.2 +VLAN-tag • 802.3 + 802.2 + VLAN-tag +VLAN-tag • 802.3 +802.2 + SNAP • 802.3 + 802.2 + S NAP + VLAN-tag • 802.3 +802.2 + SNAP + VLAN-tag + VLAN-tag • 802.3 + 802.2 + S NAP + MPLS Includes the following L3/L4 Protocols: • IP, UDP, TCP, RTP
Payload Compression	
PTP (Precision Timing Protocol)	
RANOP with E1	
dSCPC with VMS	
Entry Channel Mode (ECM)	
AES-128	
Return Link ACM	
ACM/VCM on the Outbound	
Comtech Dynamic Routing Protocol (for the management network)	
Multicast	
IPv6 (traffic ports only)	
VLAN trunking	
VLAN Access Mode on the CDM-840	
CTOG-250 and CDD-880 device redundancy with the VMS	

The following features are **not** supported when in BPM Mode:

- The standalone CDM-800* does not support BPM due to packet per second limitations.
- Single Hop on Demand (SHOD) Mesh.
- CDD-880 Port Diversity.

Starting with Firmware Ver. 1.5.1.X, the CDM-800 no longer supports standalone mode. The CDM-800 must be paired with a CTOG-250.

The Advanced VSAT BPM Working Mode has the following detailed specifications:

Attribute	Value	Comments
Maximum Ethernet Frame Size	2018 Bytes	Includes FCS but not the preamble
Working Mode	Routing or BPM	All units in the network MUST be configured the same. All units in the network must be configured to "BPM" for BPM to function as expected.
Traffic port	Bridge in BPM Mode Routed in Router Mode	
Manage Port	Always in Router Mode (not configurable)	Applies to CTOG-250, CDM-840, CDD-880
VLAN Access Mode Support	CDM-840 will support VLAN Access Mode for a single VLAN ID.	Access Port VLAN ID = 1..4095
WAN Labels	1-2047	Must be unique across all CDM-840s that shared a CTOG-250 Outbound Carrier. WAN Labels seamlessly provide hardware level filtering to improve network performance.

C.9 Summary

The Advanced VSAT Bridge Point-to-Multipoint feature and functionality enables the support of network architectures requiring IEEE 802.1Q Standards in a number of simple yet powerful network deployments. This is made possible in Advanced VSAT Firmware Version 1.5.X.X, while taking advantage of all of the features and benefits of the Advanced VSAT Solutions platform.

C.10 Glossary

Term	Definition
ACM/VCM	Adaptive Coding and Modulation / Variable Coding and Modulation
Bridge Mode	This Advanced VSAT Network Working Mode configures the Traffic ports of the CTOG-250 and CDM-840 to function as a Bridge.
BPM Mode	Bridge Point-to-Multipoint Mode
Comtech Dynamic Routing Protocol (CDRP)	CEFD Proprietary protocol that automatically synchronizes the CTOG-250's Route table with the CDM-840's LAN connected routes – i.e., the routes that are directed to the LAN ports of the CDM-840.
CTOG-250	Comtech Traffic Optimization Gateway 250.
Entry Channel Mode (ECM)	Shared Aloha channel used in Vipersat dSCPC Mode that allows a remote terminal to gain access to the Network.
Flat Network	A network in which all devices are directly connected to each other and all devices are on the same IP subnet.
IGMP	Internet Group Management Protocol
Router Mode	This Advanced VSAT Network Working Mode configures the Traffic ports of the CTOG-250, CDD-880, and CDM-840 to function as a Router.
Single Hop on Demand (SHOD)	This CEFD technology allows for dynamic creation of Single Hop Mesh connections from one CDM-840 to another CDM-840. *SHOD requires the Vipersat Management System (VMS).*
VLAN Access Mode	This mode, only available in the CDM-840, forces the Traffic Interface to carry traffic for only one user-configured VLAN.
VLAN Trunking Mode	This is the **default** mode for BPM, where all packets (with and without VLAN tags) arriving at the CTOG-250 and CDM-840 pass through the system without modification. A trunked port can pass two or more VLANs on the interface.

Appendix D. HEADER AND PAYLOAD COMPRESSION

D.1 Introduction

Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

Header and Payload Compression are standard features provided in Comtech EF Data's Advanced VSAT Series group of products, including the CDM-840 Remote Router.

The CDM-840 implements Payload Compression via the presence of a GZIP ASIC on the CDM-840 main board. This integrated circuit provides the transmit compression and receive decompression capabilities for maximum throughput and efficiency.

With Header Compression, the compression library that is incorporated into the CDM-840 for all IP traffic can reduce 40-byte IP/UDP/RTP headers to as little as one (1) byte, or as little as three (3) bytes for TCP/IP. For Voice-over-IP (VoIP), Header Compression provides bandwidth savings greater than 64%.

For example, using an 8kbps G.729E voice codec requires 24 kbps of IP bandwidth once encapsulated into an IP/UDP/RTP datagram. With Comtech EF Data's Header Compression enabled, the same voice call requires only an approximate 8.5 kbps – a savings of almost 65%. Additionally, bandwidth requirements for typical Web/HTTP traffic can be reduced by 10% or more with TCP/IP Header Compression operation enabled.

With Payload Compression, the required satellite bandwidth can be reduced by as much as 40 to 50% based on Calgary Corpus files. The compression algorithm can be applied to all data, SLE and DVB-S2 header excluded. Compression statistics are fed back to the Quality of Service (QoS) system in order to maximize WAN utilization while maintaining priority, latency, and jitter.

D.1.1 Traffic Optimization

Traffic optimization through payload compression is provided on the CDM-840 using Comtech AHA Corp. compression technology via its installed ASIC. The CDM-840 ostensibly supports a hardware-accelerated compression algorithm based on GZIP, a file format standard where the underlying compression algorithm is called **Deflate**. Deflate is a compression algorithm that is

widely available as an open-source software tool; it does not require the use of a software license.

Deflate-compressed blocks are wrapped with a header and footer to become GZIP files. Typically, when a classical, single, general purpose CPU performs GZIP compression, either the compression performance is scaled back to maximize data throughput speeds, or the CPU runs slow. To negate either deficiency, an efficient solution is to offload the compression task to a hardware-based GZIP function, as is accomplished with the CDM-840. Hardware-based GZIP compression offloads lossless data compression and frees up the system's main CPUs. This allows the compression functions to operate not only independently, but also at much higher data rates if needed. The ASIC takes in uncompressed input data, compresses it, and outputs the data in compressed form. The compression hardware does many tasks in parallel, only offloaded from the central CPUs of the CDM-840. This effectively eliminates the multi-pass and iterative nature typical of a classical, single, general purpose CPU that is over tasked with executing the Deflate algorithm.

D.1.2 Compression Performance

Compression performance is classically measured by two metrics – size reduction and data throughput:

- Size reduction is usually reported as a ratio of the uncompressed original size divided by the compressed size.

- Data throughput is measured in bytes per second (bps) as measured on the uncompressed side of the GZIP ASIC.

Data complexity has no effect on data throughput. Easy-to-compress data files that compress with a high ratio pass through the co-processor at the same high data rate as very complex data, which achieves lower compression ratios.

Table D-1 provides Comtech AHA GZIP compression ratio results as compared with the Calgary Corpus and Canterbury Corpus industry standard file sets and algorithms. The HTML file set is from a collection of Internet dynamic content; LZS (Lempel-Ziv-Stac) compression results are based on publicly available descriptions of the LZS algorithm.

Table D-2 outlines the comparison the effects of the CTOG specification for current operation, based on a session-based compression for which the current performance specifications are given.

Table D-1. Comtech AHA GZip Performance Comparisons

File Sets	Comtech AHA363-PCIe	LZS	ALDC
Calgary Corpus	2.7:1	2.2:1	2.1:1
Canterbury Corpus	3.6:1	2.7:1	2.7:1
HTML	4.4:1	3.4:1	2.65:1

Table D-2. Comtech AHA GZip Performance Specifications Support

Description	Specification
Number of TX compression sessions supported	64,000
Session history size supported	2048
Granularity of control	Per route basis
Refresh rate	1 to 600 packets or 1 second whichever comes first
Compatibility	Packets compressed by the CDM-840 transmitter will be decompressed without error by the CDM-840 receiver.

D.2 Operating, Configuring, and Monitoring Header and Payload Compression

Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

Use the following CDM-840 Web Server Interface pages for the configuration, operation, and monitoring of Header and Payload Compression:

- **Configuration | Routing | Routes**
- **Configuration | WAN | Mod | ACM**
- **Configuration | WAN | Compression**
- **Status | Statistics | Compression**

D.2.1 Enabling or Disabling Header and Payload Compression Operation

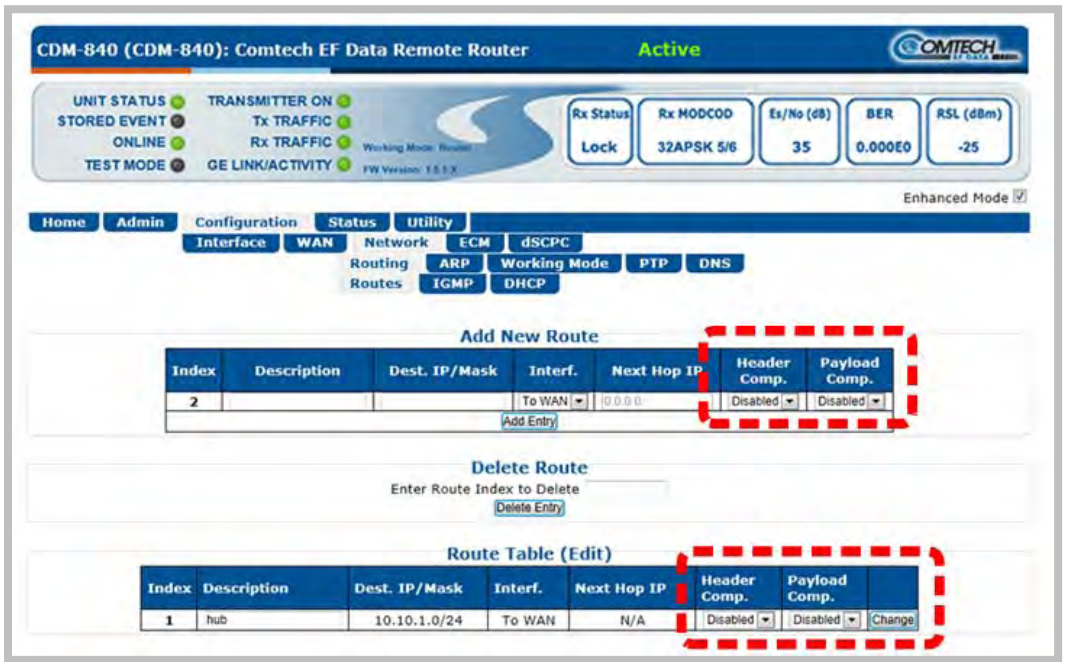


Figure D-1. Configuration | Routing | Routes page

Use the **Configuration | Routing | Routes** page (**Figure D-1**) to **enable** or **disable** Header and Payload Compression operation when operating in Router Mode.

When operating in Bridge Point-to-Multipoint (BPM) Mode, use the Bridged Point-to-Multipoint Configuration on the Compression Configuration Page. This will enable and disable the Header and Payload compression for the entire Transmit path.

When **enabled**, the CDM-840 automatically identifies supported packets for Header Compression. The only configurable settings are the Header and Payload Compression Refresh Rates.

Header and Payload Compression is independent from QoS. The enabling or disabling of this feature is required only on the sending Comtech EF Data VSAT products (CDM-840, CTOG-250, or standalone CDM-800). The need to Header and Payload Decompress incoming packets on the CDM-840 or CDD-880 is automatic and transparent to the user.

D.2.2 Configuring Header and Payload Compression Refresh Rates

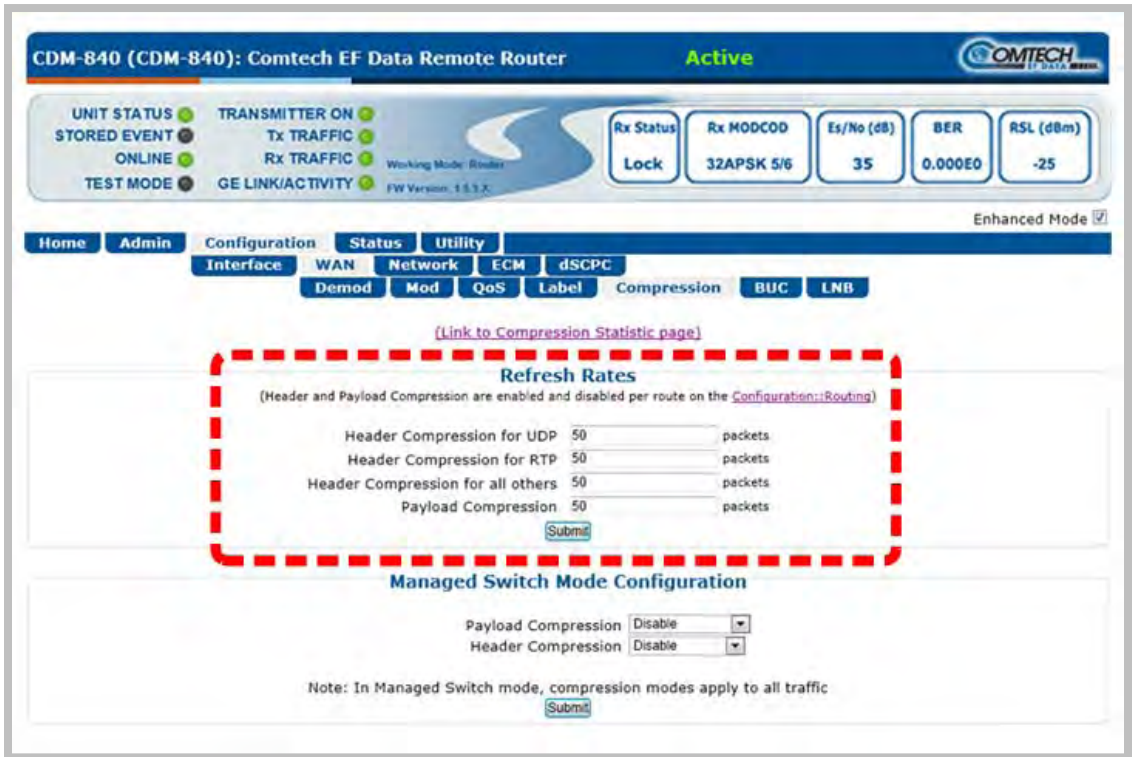


Figure D-2. Configuration | WAN | Compression page

Use the **Configuration | Compression** page (**Figure D-2**) to define the Header and Payload Compression Refresh Rates. These settings control how many compressed header packets are sent before a single full header packet is sent.

The supported refresh rates are based on the runtime characterization that there will be, at most, 600 packets seen between refreshes. Additionally, even though the runtime supports 64,000 Tx compression sessions, it is only necessary to have context storage for a small number over those 600 packets. Based on this specification, the CDM-840's compression performance is defined in **Table D-3** (±5% with different compression refresh rates).

Table D-3. Compression Performance

Packet Size	% Savings per Compression Refresh Rate				
	1	25	50	300	600
40	23%	50%	53%	53%	55%
420	40%	51%	51%	51%	51%
800	46%	53%	53%	53%	53%
1200	49%	54%	54%	53%	54%
1472	50%	55%	55%	55%	55%

While some compressed header traffic can be lost during deteriorated satellite link conditions, the CDM-840 tries to minimize that when Adaptive Coding and Modulation (ACM) is enabled (Figure D-3). Sending a full packet allows the return of the traffic stream; you may increase the Refresh Rate (smaller value) when poor satellite link conditions are prevalent or, conversely, decrease the rate (larger value) under clear sky condition operations.

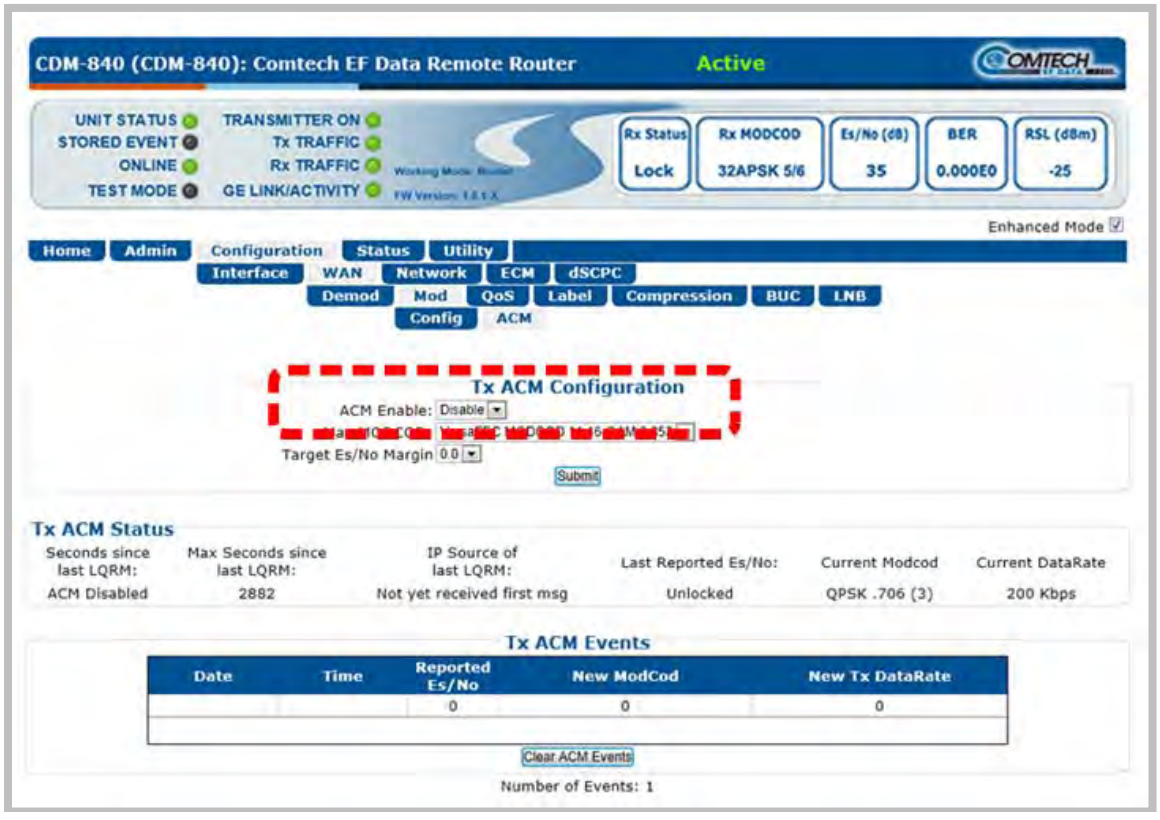


Figure D-3. Configuration | WAN | MOD | ACM page

D.2.3 Viewing Header and Payload Compression Statistics

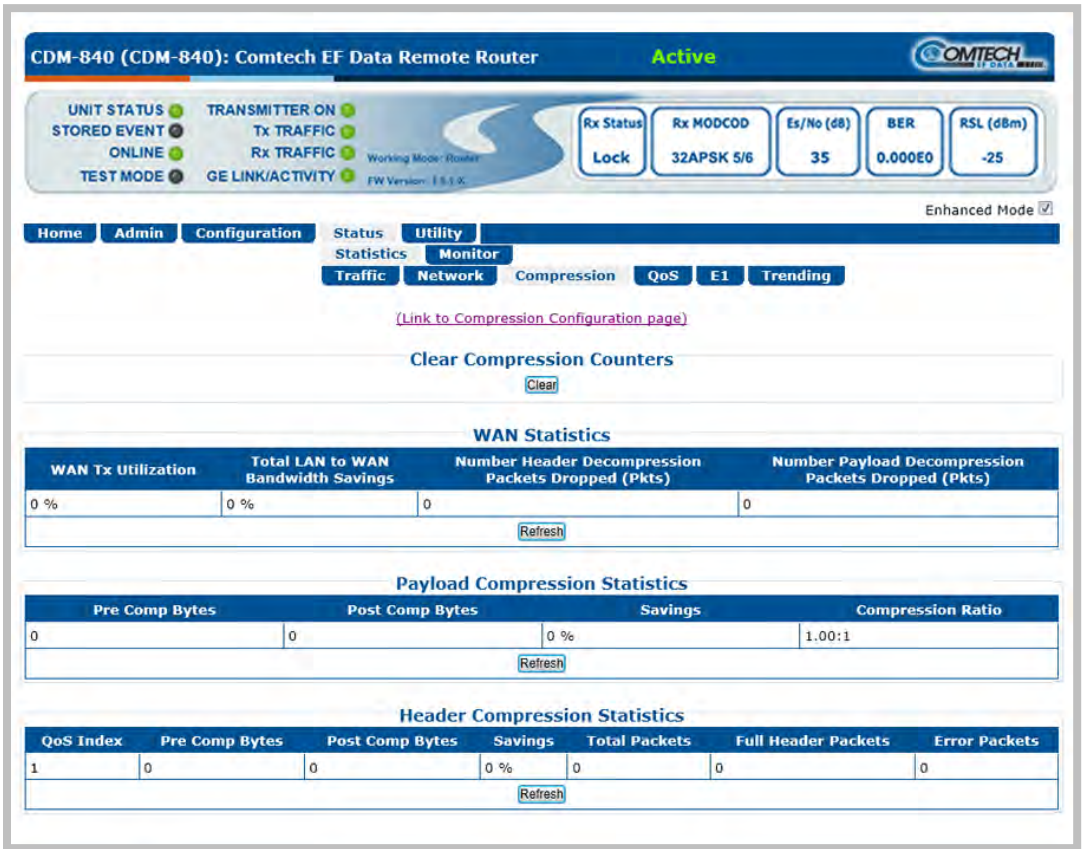


Figure D-4. Status | Statistics | Compression page

Use the **Status | Statistics | Compression** page (**Figure D-4**) to review Header and Payload Compression statistics – the total bytes of the pre-compressed and post-compressed traffic and effective compression ratio. The CDM-840 supports header compression for Ethernet, and Layer 3, 4, and 5 headers.

The CDM-840 currently supports Routing Mode operation only, so Layer 2 headers are not transmitted over the satellite link. Therefore, there is no need for Layer 2 header compression.

Supported Ethernet Headers		
• Ethernet 2.0	• 803.3+802.2 + SNAP + VLAN tag	• 803.3+802.2 + SNAP
• Ethernet 2.0 + MPLS	• Ethernet 2.0 + VLAN tag	• 803.3+ SNAP + MPLS
• 802.3-raw _ VLAN tag	• 802.3-raw	
• 803.3+802.2 + VLAN tag	• 803.3+802.2	

Supported Layer 3 and Layer 4 Headers	
• IP	• TCP
• RTP (Codec Independent)	• UDP

Appendix E. DATA COLLECTION

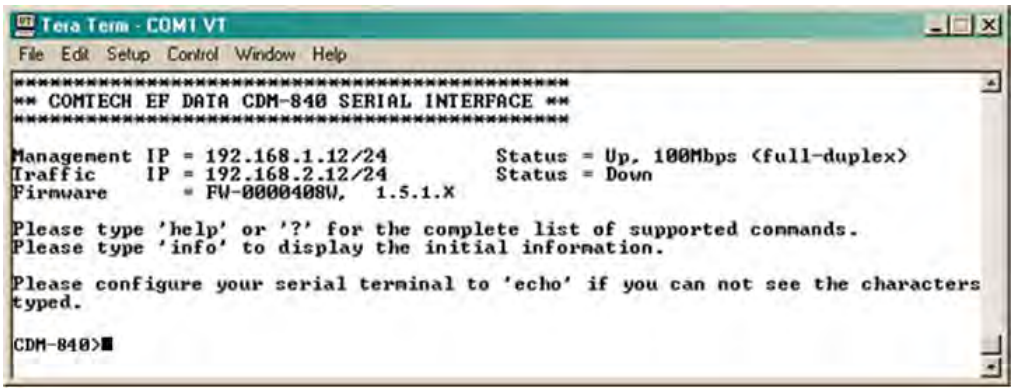
E.1 Introduction

In the event that an operational issue (such as degraded performance or loss of IP access) is encountered with an onsite (field-installed) CDM-840 Remote Router, it is crucial for Comtech EF Data Product Support to receive diagnostic information collected from the onsite unit in question in order to properly investigate and resolve the issue.

This appendix instructs you on the procedures required to collect this diagnostic information from an onsite CDM-840 Remote Router. The procedures described in this appendix require a user-supplied, Windows-based PC and a custom Serial Adapter Cable[1].

Perform these procedures in the following sequence:

1. You must first use the User PC to obtain *pre-reboot* information* from the onsite CDM-840. Accomplish this by text capture with a user-supplied terminal emulation program (such as Tera Term or HyperTerminal) installed on the User PC. You must use this terminal emulator to access the CDM-840 Serial Interface, for serial communication (via the custom Serial Adapter Cable connection) between the CDM-840 and the User PC.



**** You must gather this information while the issue exists. Do not reboot the CDM-840 for any reason until otherwise instructed in this appendix.***

[1] *See **Sect. E.5** in this appendix for the fabrication specifications required by the custom Serial Adapter Cable that must be provided by the user for use in this procedure.*

2. Once you gather this initial pre-reboot information, you must reboot the CDM-840 to re-initialize and restore service.

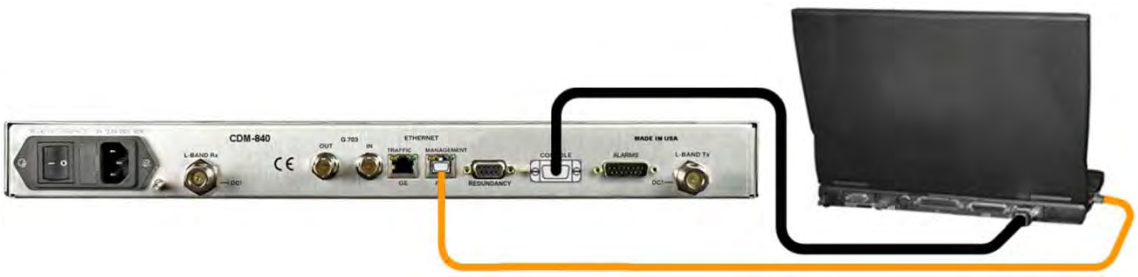
3. In addition to collecting the pre-reboot Serial Interface text capture file, after the CDM-840 reboots you must retrieve its onboard data collection files via Ethernet connection, and transfer these files to the User PC:

   - The "**cdm840slot0.xml**" file, which contains the CDM-840 modem configuration settings;

   - The "**log0**", "**log1**", and "**log2**" files, which contain debug information.

4. Assuming that the User PC is equipped with the appropriate Internet access and e-mail capabilities (Internet Explorer, for example), you musty e-mail these pre- and post-reboot files to Comtech EF Data Product Support for evaluation.

E.2 Initial Setup of Communications Between the CDM-840 and the User PC



CAUTION: Obey precautions for handling electrostatic-sensitive devices.

A. Connect the custom Serial Adapter Cable between the CDM-840 'CONSOLE' port and an available RS-232 serial port on the User PC.

B. Connect a CAT5 Ethernet cable between CDM-840 Ethernet 'MANAGEMENT | FE' port and an available Ethernet network RJ-45 port on the User PC.

C. Use the terminal emulator program to configure the serial port communication and terminal display operation as follows:

   - 38400 bps (Baud Rate)
   - 8 Data Bits
   - 1 Stop Bit
   - Parity = NO
   - Port Flow Control = NONE
   - Display New line Rx/Tx: CR
   - Local Echo = ON

D. Upon successful setup of communications between the User PC and the CDM-840 Serial Interface, you will see the remote command prompt on the terminal emulator display: "->".

E. Using Windows Command-line (Start > Run... > cmd.exe), create a folder (directory) named "temp" (or some other easy-to-remember name) on the User PC for placement of the text capture file, CDM-840 configuration file, and the data collection files:

Example: **`C:\>md temp`**

F. Set the terminal emulator program to capture the Serial Interface session to a text file. Be sure to specify your "temp" folder as the destination path for this text file.

Refer to your terminal emulator program User Guide or Help feature for instructions on configuring the serial port communications and for creating and saving text capture files.

You are now ready to begin pre-reboot collection of diagnostic information from the CDM-840.

E.3 Collection of Pre-Reboot Diagnostic Information from the CDM-840

CAUTION: The pre-reboot information collection process differs depending on which firmware version is running on your unit. Be sure to select and follow the correct procedure.

Follow these steps to collect pre-reboot information from a CDM-840 using* Firmware Version 1.3.3 or newer*:

To do this:	*Type this at the Serial Interface "->" prompt:*
Confirm that the Interfaces are operational	`->display_diag_info` *Note: You may be prompted to press "enter" and press "y <CR>" a few times.*
Collect log files	`->LoggerSnapshot` *Wait 30 seconds.*
End the Serial Interface text capture session – be sure to verify that you save the file to your "temp" folder successfully before rebooting.	*Refer to your terminal emulator program User Guide or Help feature.*
You may now reboot the CDM-840 and proceed to E.4 Collection of Post-Reboot Diagnostic Information from the CDM-840.	

Follow these steps to collect pre-reboot information from a CDM-840 using **Firmware Version 1.3.2 or older*:***

To do this:	***Type this at the Serial Interface "->" prompt:***
Confirm that the interfaces are operational	->**ifconfig** ->**ping *"LAN IP Address"*** ▶ Get the configuration ->**cimmib_display_settings**
Confirm that the WAN and DMA are receiving and transmitting traffic	->**wan_dll_stats_print** ->**dma_stats_show 0** ->**dma_stats_show 1** ->**dma_stats_clear 0** (Answer 'y' to clear stats) ->**dma_stats_clear 1** (Answer 'y' to clear stats) ▶ Now wait 30 seconds ->**dma_stats_show 0** ->**dma_stats_show 1**
Determine that QoS and Classifier are OK	->**qos_priorities_display** ▶ Now wait 5 seconds ->**qos_priorities_display**
Display the reset of system context	->**display_full_system_info**
Get the system state	->**i** ->**spy** ▶ Now wait 10 seconds ->**spyStop**
Get kernel memory dump	->**cmd** ▶ You will see the Command-line CMD> prompt CMD>**slab**

To do this:	*Type this at the Serial Interface "->" prompt:*
End the Serial Interface text capture session – be sure to verify that you save the file to your "temp" folder successfully before rebooting.	*Refer to your terminal emulator program User Guide or Help feature.*
You may now reboot the CDM-840 and proceed to E.4 Collection of Post-Reboot Diagnostic Information from the CDM-840.	

E.4 Collection of Post-Reboot Diagnostic Information from the CDM-840

A. "Ping" the CDM-840 to verify the connection and communication:

i. Set the IP address of the CDM-840 so that it is in the same IP Subnet as the User PC.

Using the CDM-840 Serial Interface:

- *Connect serial cable as described in above procedures for collecting information*.
- *Press enter multiple times and you should see CDM-840>* prompt
- *Set IP Address and Subnet using the following command (configure the terminal emulator Local Echo=ON to see what you type):*

CDM-840> <0/IPA=xxx.xxx.xxx.xxx/ss

Where xxx.xxx.xxx.xxx is the IP Address and ss is the number of Subnet bits.

Example: **<0/IPA=192.168.0.1/24**

ii. UseCommand-line to "ping" the CDM-840.

At t he W indows C ommand-line p rompt, t ype **ping xxx.xxx.xxx.xxx** (where "**xxx.xxx.xxx.xxx**" is the Management IP Address of the CDM-840).

The results should confirm whether or not the CDM-840 is connected and communicating.

B. Collect the configuration and log files file from the CDM-840 using File Transfer Protocol (FTP):

To do this:	*Type this at the Windows Command-line prompt:*
Change to the User PC "temp" folder	`CMD>cd /temp`
Open the FTP session to the CDM-840	`CMD>ftp xxx.xxx.xxx.xxx` (where "`xxx.xxx.xxx.xxx`" is the Management IP Address of the CDM-840).
Log in as Administrator	(At the prompts, the default username and password are `comtech123` and `comtech123`)

To do this:	*Type this at the Windows Command-line prompt:*
Select binary transfer mode	ftp>**bin**
Change to "tffs" folder	ftp>**cd /tffs**
Retrieve the CDM-840 configuration file	ftp>**get cdm840slot0.xml**
Collect log files (they may or may not exist)	ftp>**get log0** ftp>**get log1** ftp>**get log2**
Terminate the FTP session	ftp>**quit**

C. Forward the data collection files to Comtech EF Data Product Support:

i. Prepare your e-mail and address it to Comtech EF Data Product Support.

ii. Attach the Serial Interface capture, "cdm840slot0.xml", and any log files ("log0", "log1", "log2") to your e-mail.

iii. Send your e-mail to Comtech EF Data Product Support.

The Data Collection and Reporting Process is now complete.

E.5 Serial Adapter Cable Fabrication Specifications Reference

CAUTION: To ensure proper operation, fabrication of this Serial Adapter Cable requires that :

- You must wire the connectors using the pinout tables and diagram provided here.
- Type 'D' connectors must have back-shells with continuous metallic shielding.
- Type 'D' cabling must have a continuous outer shield (either foil or braid, or both). The shield must be bonded to the connector back-shells.

User PC Interface End
Description: PC Serial Port Interface

Cable Connector Type: D-Subminiature DB-9F
(Type D-Sub 9-pin Female)

Use: For connection to the User PC RS-232 Serial Port

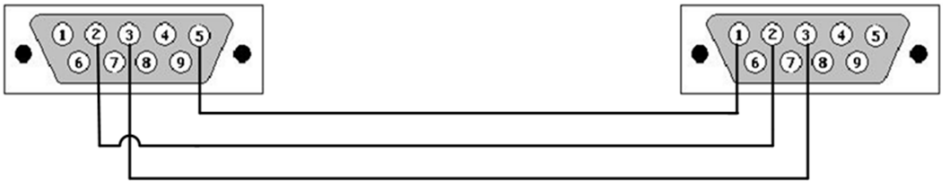
CDM-840 Onsite Unit Interface End
Description: CDM-840 'CONSOLE' Port Interface

Cable Connector Type: D-Subminiature DB-9M
(Type D-Sub 9-pin Male)

Use: For connection to the CDM-840 Onsite Unit 'CONSOLE' Port

WIRE LIST / PINOUT			
PIN	SIG	NAME	DTE (PC)
1	DCD	DATA CARRIER DETECT	IN
2	RXD	RECEIVE DATA	IN
3	TXD	TRANSMIT DATA	OUT
4	DTR	DATA TERMINAL READY	OUT
5	GND	SIGNAL GROUND	--
6	DSR	DATA SET READY	IN
7	RTS	REQUEST TO SEND	OUT
8	CTS	CLEAR TO SEND	IN
9	RI	RING INDICATOR	IN

WIRE LIST / PINOUT		
PIN	ASYNCHRONOUS	SYNCHRONOUS
1	GROUND	GROUND
2	RS-232 Rx DATA OUT	RS-232 Rx DATA OUT
3	RS-232 Tx DATA IN	RS-232 Tx DATA IN
4	--	RS-232 Rx CLOCK OUT
5	--	RS-232 Tx CLOCK OUT
6	RS-232 Tx DATA 'B' IN	--
7	RS-232 Tx DATA 'A' IN	--
8	RS-232 Rx DATA 'B' OUT	--
9	RS-232 Rx DATA 'A' OUT	--



Notes:

Appendix F. ENTRY CHANNEL MODE (ECM)

F.1 Functional Overview

Comtech EF Data CDD-880 Multi Receiver Router Installation and Operation Manual (CEFD P/N MN-CDD880)

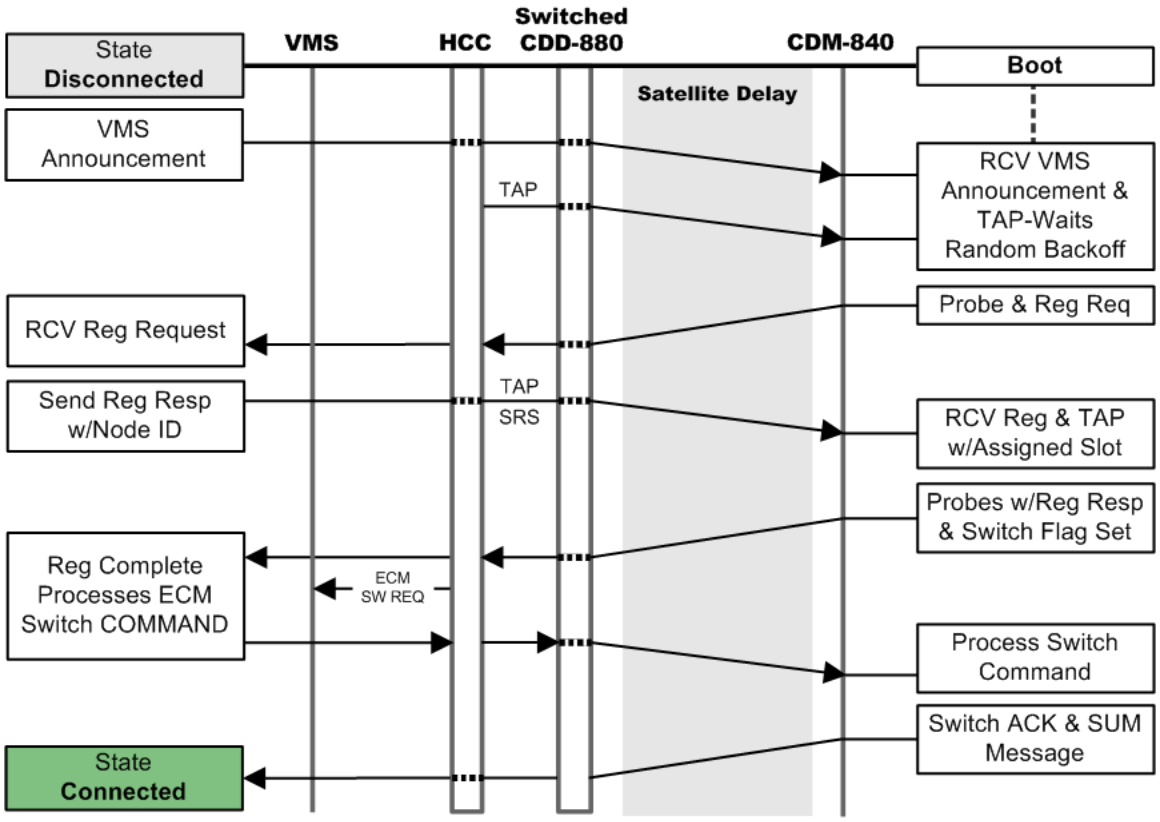


Figure F-1. ECM – Message Processing Diagram

Figure F-1 illustrates the processing diagram for Entry Channel Mode (ECM) messaging. ECM is a feature based on slotted Aloha with random retransmission backoff. ECM supports multiple carriers through frequency assignments, which provide simplified deployment and scalability. In a typical Comtech EF Data Advanced VSAT System network, the CDM-840 Remote Router supports ECM as an installed component of a typical remote site cluster.

While a CDM-840 is in Entry Channel Mode, it allows the passing of management traffic only – it will not transmit user data traffic. An ECM-enabled CDM-840 may remain in the entry channel for an extended period if "online" communications are not required, or if dSCPC (Dynamic Single Carrier Per Channel) resources are unavailable. While idle or waiting in the entry channel, the CDM-840 sends periodic health status messages while it continues to service VMS recovery logic timers.

Note that a "channel" refers to a fixed carrier slot on the satellite that allows the CDM-840 Remote Router random access (in time) to a readied **HCC** (**H**ub **C**hannel **C**ontroller) for transacting each acquired transmission. The HCC is a CDD-880 Multi Receiver Router that serves as a dedicated hub demodulator selected (mode set) as an ECM controller. Each CDD-880 supports only one Entry Channel; this channel is always assigned to Demod #1.

The HCC uses a **TAP** (**T**ransmission **A**nnouncement **P**rotocol) message to broadcast a key subset of transmit parameters that match its receive configuration, but assumes all other site specific parameters were preconfigured at the time of antenna commissioning. In addition, the TAP provides timing information in the form of slot parameters that define the required acquisition time of the receiver and the amount of time allowed for data transmission. The TAP also contains a list of CDM-840s that successfully transmitted during the previous cycle. The list of CDM-840s from which the HCC expected – but did not receive – a response is also provided; these CDM-840s are assigned a slot for the next cycle.

Each associated CDM-840 achieves loose time synchronization via the broadcast TAP message transmitted at periodic intervals. Since the TAP transmits via the satellite, all CDM-840s receive it at effectively the same time, with delay differences (due to geographic variation of each remote site cluster) compensated with a specified guard time. Upon receipt of the TAP message, the CDM-840 resets its ECM time reference and uses the slot information to determine/select the next transmit opportunity:

- If the CDM-840 has transmitted in the previous cycle, and does not indicate it is finished, it receives an assigned slot as indicated by its IP Address.

- If the CDM-840 does not have an assigned slot, it randomly picks one from the available contention slots.

- If no contention slots are available, the CDM-840 waits for the next cycle.

This process allows each CDM-840 to transmit at a discrete time to minimize the chance of collision. To reduce slot contention further, a random backoff (next slot) algorithm is deployed if the transmission was not received. Each CDM-840 attempts to enter the network by gauging its transmissions from this timing reference, randomly picking one of the **S**et **A**loha **S**lots (**SAS**) presented by the TAP message. The transmit "on" time is of a fixed duration, allowing sufficient time for the receiving CDD-880 to acquire and pass the management signaling messages. The CDM-840 will continue to attempt access on cadence intervals using random backoffs, selecting a different SAS until receiving positive acknowledgement from the HCC.

Upon valid reception, the HCC processes the **R**emote **Id**entification (**RID**) packet containing the CDM-840 IP Address, TAP (Group) ID, and ECM state flags. Each CDM-840 sign-on IP Address is added to a list of CDM-840(s) that are queued and await assignment.

Depending on the ECM state flag, the CDM-840 either remains idle in the channel or is assigned one of the next available time-sensitive slots. Each slot, labeled as a **S**et of **R**egistration **S**lot (SRS), is also assigned through the TAP and allows the CDM-840 to complete any necessary transaction without further contention.

The CDM-840 then holds an SRS until it receives its assignment into dSCPC or determines that all necessary transactions are complete; at this time, it releases the slot by signaling the HCC through the RID message.

Upon release of the slot, the HCC re-assigns it to the group of contention slots. This cycle repeats until all CDM-840s either have been switched to dSCPC channels or require no further interaction.

Once the CDM-840 indicates that registration with VMS is complete (via one of the flags in the RID message), on behalf of the CDM-840 the HCC requests dSCPC assignment by placing the CDM-840 IP Address into the “switch pending” list and sending an ECM type switch request message to the VMS. The VMS, upon receipt, either *grants* the request and signals the HCC to remove the CDM-840 from its list, or *ignores* the request and leaves the CDM-840 in the “switch pending” list. The HCC repeats this request at 12-second intervals up to five times before it removes the CDM-840 from the “switch pending” list. While the CDM-840 is in this “switch pending” ECM state, it continues to send SUM health status update messages to the VMS on timed intervals. Since all ECM transmissions from the CDM-840 contain a RID, this causes the CDM-840 to be placed back in the “switch pending” list. This cycle continues until the CDM-840 switches, or is set to ECM **Wait** state, or goes offline.

The VMS is the last step in the entry process that provides network registration, and grants or ignores dSCPC resources. If resources are limited because of bandwidth, hardware, or unavailability, the CDM-840s will remain in the entry channel pending assignment.

The VMS plays no role in ECM timing or control.

F.2 Entry Channel Mode Operation

See Sections* F.1 Functional Overview *and* F.4 Glossary of Terms *for descriptions of the terminologies referred to in this section.

F.2.1 ECM Configuration using the Web Server Interfaces

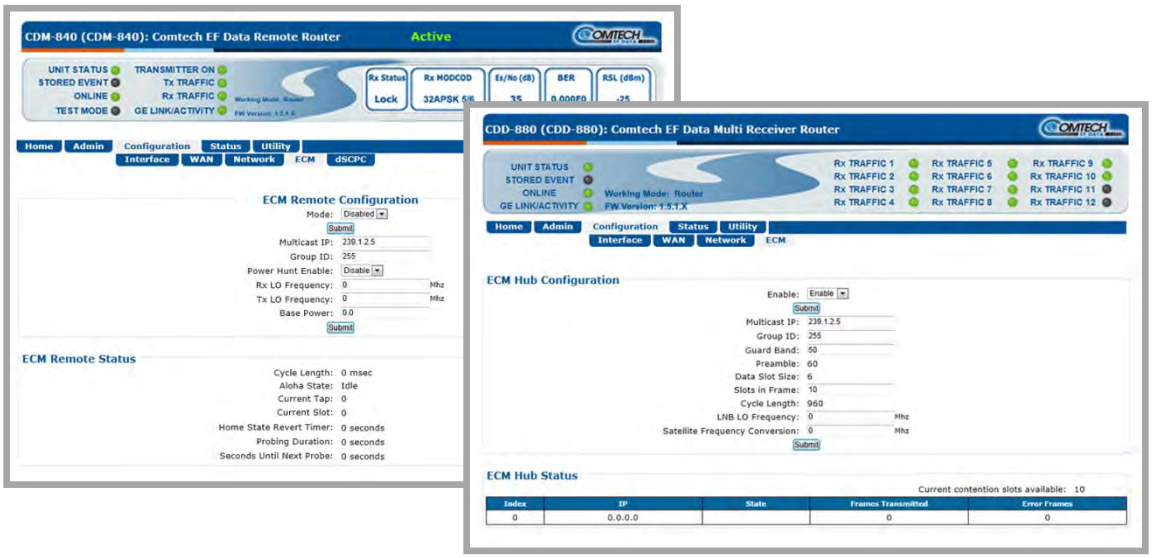


Figure F-2. CDM-840 and CDD-880 'Configuration | ECM' pages

Proper deployment of ECM in the Advanced VSAT Network requires complimentary configuration of both the hub site CDD-880(s) and the remote site CDM-840(s) using each product's Web Server Interface **'Configuration | ECM'** page (**Figure F-2**):

- Use the CDM-840 Web Server Interface to configure one of three modes (states) of ECM operation: **Online**, **Wait** or **Offline**.

- Use the CDD-880 Web Server Interface to configure a basic set of parameters that define the channel group. The settings consist of Enabling, TAP Multicast IP Address, TAP (group) ID, Guard Band and a total count of Slots in Frame (combined SAS and SRS) per cycle.

In addition, you must specify an LNB LO Frequency and Satellite Frequency Conversion to accommodate mismatches between the hub site LNB and remote site BUCs. Channel parameters are determined from the CDD-880 configuration settings. If spectral inversions apply, all hub receiving CDD-880s that are part of that downlink chain must be set to match.

F.2.2 CDM-840 Remote Router Terminals

Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

For the CDM-840: Select the ECM mode as **Online**, **Wait** or **Offline**. Each ECM state establishes a different role for the CDM-840 in the overall Advanced VSAT Network operations:

- **Online** – This is the most common ECM state, whereby the CDM-840 powers up, requests network registration, and switches to dSCPC at the minimum site policy data rate setting.

- **Wait** – Keeping a CDM-840 in the ECM channel can result in *oversubscription*, where some percentage of CDM-840s waits their turn for SCPC pooled resources. To avoid oversubscription, this ECM state provides the network operator with the ability to selectively control the CDM-840s through manual, scheduled, or externally switched request commands.

  With the CDM-840s set to **Wait**, they continue to send their health status update messages to the VMS and to the CTOG-250 Comtech Traffic Optimization Gateway (with integrated CDM-800 Gateway Router). The VMS messages update connected link status; when dynamic routing mode is enabled, the ACM, CDRP, and data traffic statistics messages sent to the CTOG-250 maintain the forward path ACM and routing tables.

- **Offline** – In this ECM state, the CDM-840 does not transmit and remains idle until a new ECM state is selected either locally or from the VMS. Examples for use of this particular ECM state are COTM (communications on the move) or military maneuvers providing radio silence conditions.

Figure F-3 illustrates the internal logic diagram of the remote processing registration message.

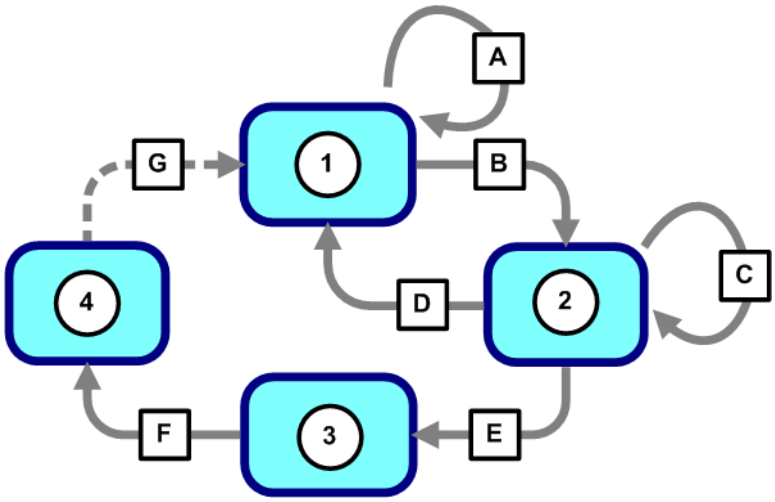
- The CDM-840s are configured to receive the outbound carrier and are given a TAP (Group) identifier number (default 1) that sets the internal filtering if multiple TAPs are used.

- Upon receipt of the TAP message, the CDM-840 sets modem transmission parameters (if required), initializes timing, and picks at random an SAS to start entry by sending a *probe* (slot transmission).

- The CDM-840, based on its current ECM state, either requests an *assigned slot* or waits to be *switched*:

  - An *assigned slot request* indicates to the HCC if the CDM-840 has more data (e.g. registration protocol) to send.

  - A *switch request* indicates that the CDM-840 is requesting dSCPC bandwidth. These two flags are independent.



Processing Segment	Description	Remarks
1	ALOHA	"Not Registered" or "Reverted"
2	REGISTRATION	
3	SWITCH PENDING	
4	SWITCHED	

Action	Remarks
A	Random attempts with backoff until in TAP
B	In TAP
C	Send Registration Protocol until complete
D	Not in TAP
E	Registration complete – no more Slots needed
F	Received "Switch Command" message from VMS
G	Received "Revert" message from VMS

Figure F-3. ECM Message Processing – CDM-840 Remote Router

F.2.3 CDD-880 Hub Channel Controller (HCC)

Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT

F.2.3.1 Tap Message

The TAP message is a standard UDP/IP multicast forward over the outbound channel with a payload containing the following sections:

- Standard Vipersat Header (distinguishes TAP from other Vipersat messages)
- Timestamp field (set by CDM-840 [at WAN interface] when TAP is received)
- Aloha Channel Frequency Plan (Frequency, Data Rate, Modulation, and Coding)
- Slot and Timing Control
- Lists of CDM-840s with Assigned Slots (previous transmission succeeded / failed)
- List of CDM-840s that have completed their handshake in the last cycle

As noted previously, receipt of a TAP causes all listening CDM-840s to synchronize internal transmit timing clock in order to minimize collisions in the Aloha channel.

F.2.3.2 HCC Configuration

The TAP IP Address specifies the multicast address that all CDM-840s in the group use to receive the TAP:

- Timing as exposed to the user is message interval;
- Total slot count that derives the Cycle Length is set in milliseconds;
- All other parameters are calculated based on current rate;
- The Date Slot Size is fixed at 6, and VersaFEC Blocks and Preamble is computed in milliseconds based on the specified data rate;
- Guard Band is determined during terminal commissioning.

F.2.3.3 Hub Operation

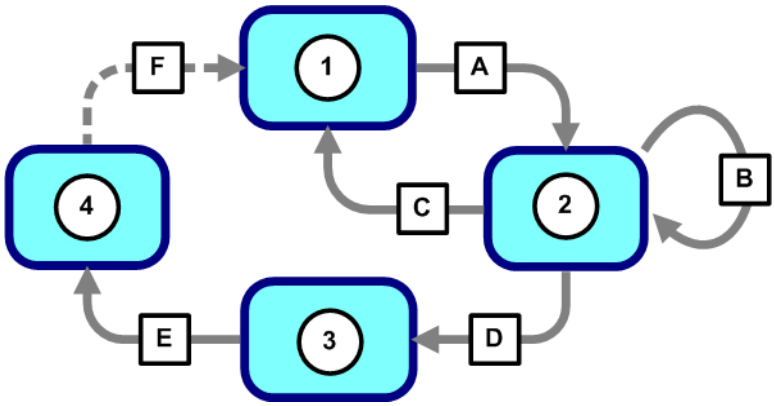
- After configuration and initialization, the HCC broadcasts the TAP message on cycle intervals waiting for Aloha channel RID messages. Successful reception of the RID places the

CDM-840 IP Address along with its ECM state flag (i.e., **Online**, **Wait**, or **Offline**) into the first queued list. The controller checks the flag to determine next operation. If the ECM state is **Online**, an SRS is assigned for next TAP processing.

- The CDM-840 receives the TAP with its IP Address in the SRS list and, based on where its place is in the sequential order, determines the slot assignment. By design convention, assigned slots are at the end of the cycle and whatever remains is used for contention at the beginning of the cycle. With the assignment, the CDM-840 transmits management data in its assigned slot and awaits acknowledgment and next assignment.

- After the CDM-840 completes its registration protocol, it releases the active flag in the next RID cycle. At this point, the HCC will remove the processing CDM-840's IP Address from the list clearing the SRS allocation. If the CDM-840 is not switched out of ECM mode, it will proceed to send a Status Update Message (SUM) every minute in order to maintain its active status with VMS. Typically, a SUM should only require one transmission unless there is contention, in which case the CDM-840 will go into back-off mode until the CDM-840 received acknowledgment from the HCC that the SUM was successfully transmitted.

Figure F-4 illustrates the internal logic diagram of the HCC processing of remote messages.



Processing Segment	Description	Remarks
1	ALOHA	
2	TAP	In "Assigned Slot" list
3	SWITCH PENDING	In "Switch Pending" list – Switch Request sent to VMS up to 5X in 12-second intervals until response
4	SWITCHED	

Action	Remarks
A	RID Detected – add to Detection List of TAP
B	RID Detected – add to Detection List of TAP
C	Missed 'N' Consecutive Cycle
D	Registration complete – no more slots needed
E	"Disable" message received from VMS
F	CDM-840 received "Revert" message from VMS

Figure F-4. ECM Message Processing – CDD-880 Multi Receiver Router

F.3 ECM Operational Scenarios

F.3.1 Scenario 1 – VMS Initial Registration Process

For proper registration with the VMS, initialization (power-up and bootup) of the ECM-enabled CDM-840 is required.

Upon initialization, the CDM-840:

1. Receives a VMS Announcement, sets up an active VMS IP Address, and initializes ECM TAP processing;

2. Transmits a registration request using a selected SAS, and sets a “Needs Slot” flag in the RID message;

3. Receives the HCC response, through the TAP, assigning an SRS;

4. Continues to transmit the registration request message in SRS;

5. Receives registration from the VMS (Standard Processing);

6. Transmits a registration acknowledgement to the VMS in SRS – it signals the HCC by clearing “Needs Slot” and sets the “Registered with VMS” and “Need to be Switched” flags in the RID message.

7. Receives the HCC response, through the TAP, as an acknowledgement – the HCC then clears the SRS allocation and sends ECM switch requests to the VMS on behalf of the CDM-840 (Standard Processing);

8. Waits for VMS dSCPC assignment (Standard Processing).

F.3.2 Scenario 2 – Reverted or Auto-Recovered Messages

“Revert” or “Auto Recover” of an already registered CDM-840 is required when:

- The CDM-840 was forced into or dropped back to ECM mode;

- The CDM-840 transmits into an SAS setting due to a “Need to be Switched” flag in the RID message;

- The HCC sends ECM switch requests to the VMS on behalf of the CDM-840 (Standard Processing).

F.3.2.1 ECM Revert Cycle Timing

When a CDM-840 reverts from dSCPC to ECM, there is typically no wait because the CDM-840 is always monitoring TAP cycles to synchronize. It then randomly selects a slot in the next cycle

and transmits. If the probe is not detected at the corresponding CDD-880 (as indicated by the next TAP to the CDM-840), it backs off by doubling the cycle and selecting another random slot. If the revert happened near the end of the cycle the CDM-840 wait for next TAP.

The **Slots in Frame** setting is determined by the number of remotes in the cluster that are either waiting in the channel or put back into the channel for recovery. Example, if there was only one CDM-840 attempting to enter the network, it would be simple to determine the number of required slots would be two – one for contention, and one for assignment. However, in any given network there may be many CDM-840s attempting to pass through the ECM channel depending on their state or network environment. Other catastrophic and potential real world conditions may include hub outage (although unlikely), sun outages, rain fade, or regional nightly power-down schedules.

In normal operations, only one to a few CDM-840s would be accessing the channel. The worst-case scenario is where all CDM-840s are placed in Aloha on the ECM channel and depending on slot count the contention will be high until the ECM controller starts to cycle down through the reception list and all CDM-840s are cleared.

In any case, it is important to accurately assign the total number of number of slots in order to reduce contention and reduce the time it takes for all CDM-840s to re-enter the network dSCPC resources. While it might seem obvious to adjust the **Slots in Frame** setting to a large number, however this could have an inverse effect, because adding more slots increases the cycle time adding potentially more delays-per-CDM-840 attempting access the channel.

While trial and error may be used to determine the correct settings (based on the actual network parameters), Comtech EF Data enables you to avoid such a tedious process with its available **ECM Calculator.** This tool, provided upon request, presents theoretical analysis, number of cycles and time to capture all waiting CDM-840s.

Contact Comtech EF Data Product Support to obtain the ECM Calculator.

F.3.2.2 ECMv2 Backoff Algorithm

The ECMv2 Backoff Algorithm optimizes between quick entry in a quiet network and minimal collisions in an active network. Its key feature is the concept of fixed-length data slots within a repeating frame (or cycle). You can control the number of slots in a frame based on the known number of CDM-840s trying to gain entry into the network. Each total slot consists of three components:

- Acquisition Preamble
- Data Segment for Management Messages
- Guard Band to resolve timing uncertainty

An integral number of VersaFEC blocks are used for both the preamble and the data segment; the guard band will vary due to system timing uncertainties and propagation delay due to the geographic dispersion of the CDM-840s.

A Guard Band of 50ms is sufficient in most cases to accommodate geographical latency differences and internal timing errors.

The preamble is pre-determined based on calibration tables for receiver acquisition at the current data rate and MODCOD. The data segment is sized to support the largest messages needed to complete the Entry Channel handshake protocol and maintain status and CDRP. The actual size (in milliseconds) of each slot is therefore a function of the data rate and the number of bits in a VersaFEC block for the ModCod of the ECM channel.

When a CDM-840 is ready to transmit, it waits for receipt of a TAP message that establishes time synchronization between all CDM-840s. The TAP message also describes the configuration of the Entry Channel Control receiver. The CDM-840 uses the information in the TAP to configure its own Tx parameters and then checks for available Aloha Slots. If slots are available, it randomly selects one of the available slots.

During heavy use, it is possible that all available slots will be dedicated to CDM-840s that have already initiated the entry handshake although this situation should never last more than two cycles unless there are collisions or degraded link state.

The slot number, multiplied by the total slot length (in milliseconds) provides the start time for transmission, which is always relative to the receipt of the last TAP message.

The total slot length is the sum of the Guard Band, Preamble, and Data Segment that are all provided in the TAP message.

After transmitting its request, the CDM-840 waits for the next TAP message that indicates if that transmission was detected by the Entry Channel Controller. If the transmission is detected, the CDM-840 receives an assigned slot in the current frame and continues to receive assigned slots until it indicates it has completed its entry protocol. If the next TAP does *not* include an assigned slot, the CDM-840 assumes a collision occurred and begins the backoff algorithm.

The backoff is based on contention levels of 2^n (where n = 0 to 4; i.e. 2^0=1, 2^1=2, 2^2=4, 2^3=8, and 2^4=16). The Contention Level always starts at **0**, which means the CDM-840 transmits in the next frame when it receives a TAP message. If the transmission is not detected, the CDM-840 goes to Contention Level **1** and picks a random slot in one of the next two frames. If it is *still* not detected, Contention Level goes to **3** and the CDM-840 randomly picks a slot in one of the next four frames.

If the CDM-840 is not detected by Contention Level **4** (16 frames), it then resets to Contention Level **0** and tries again – the CDM-840 uses one random number to select a frame at the current contention level and another random number to select a slot within the frame.

Since the CDM-840s are not aware of each other, their Contention Levels are independent and determined only by when they were initially ready to transmit.

F.4 Glossary of Terms

Abbreviation	Term	Comments
ASR	Application Switch Request	ASR is a private protocol used by the CDM-840 to request bandwidth from the VMS.
BUC	Block Up Converter	The BUC is used in the Tx (uplink) of satellite signals to convert a band of frequencies from a lower frequency to a higher frequency.
CDRP	Comtech Dynamic Routing Protocol	CDRP is used to simplify the deployment of Comtech EF Data's Advanced VSAT solution in an IP-routed network.
dSCPC	Dynamic Single Channel Per Carrier	dSCPC is a Comtech EF Data FAST Feature used to enable dynamic allocation and sharing of bandwidth among users.
HCC	Hub Channel Controller	The HCC is a dedicated CDD-880 that generates the TAP and is responsible for all request transactions from each CDM-840 while in Entry Channel Mode.
LNB	Low-Noise Block Down Converter	The LNB is the receiving device on a parabolic satellite dish used for the Rx (downlink) of satellite signals
RID	Remote Identification	The RID is a message, presented to the Hub Channel Controller upon each transmission into the Aloha channel, which contains the IP Address and control flag.
SAS	Set of Aloha Slots	SAS is used as random access for initial request messaging from the CDM-840s.
SRS	Set of Registration Slots	SRS is used for time sensitive management message transactions.
SUM	Status Update Message	SUM is used for updating VMS device control parameters, such as Tx Frequency, Data Rate, Current MODCOD, Eb/No, Es/No, ACM information, etc.
TAP	Transmission Announcement Protocol	The TAP is the time and frequency reference message sent on intervals to synchronize any listening CDM-840s into the Entry Channel.
VMS	Vipersat Management System	A VMS is a configuration, management, and control tool that is used to configure the Advanced VSAT Network and respond to network anomalies.

Appendix G. WAN/RAN OPTIMIZATION

G.1 Overview

The CDM-840 Remote Router supports E1 RAN (**R**adio **A**ccess **N**etwork) Optimization as a **FAST** option. This appendix provides detailed information about Comtech EF Data's patent pending RAN Optimization technology, which is designed to provide maximum savings while maintaining superior voice quality.

G.1.1 Radio Access Network (RAN)

Figure G-1 illustrates typical 2G and 3G Radio Access Networks.

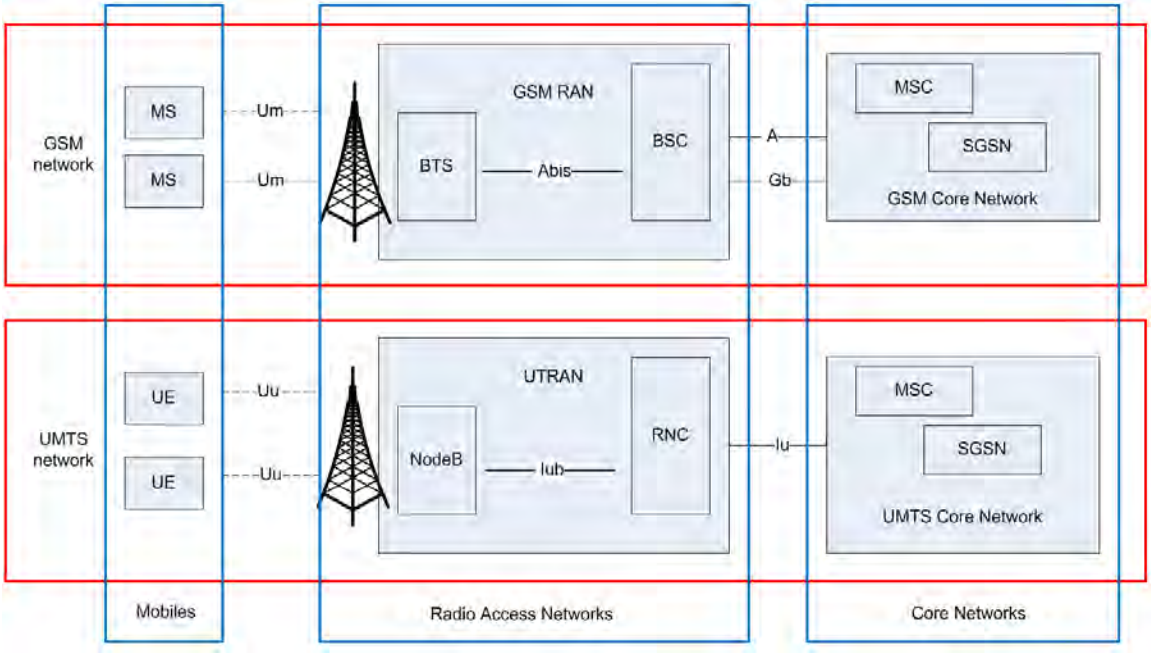


Figure G-1. 2G / 3G Radio Access Network (RAN)

In the cellular network, the RAN connects cell-site nodes with central-site nodes:

- For **G**lobal System for **M**obile Communications (GSM) / 2G, the **B**ase **T**ransceiver **S**tations (BTS) connect to the **B**ase **S**tation **C**ontrollers (BSC) via the Abis interface. Voice, data and signaling are transported over one or more E1s.

- For **U**niversal **M**obile **T**elecommunications **S**ystems (UMTS) / 3G, the NodeB connects to the **R**adio **N**etwork **C**ontroller (RNC) via the "lub" interface. Voice, data and signaling are transported over one or more E1s using **A**synchronous **T**ransfer **M**ode (ATM).

G.1.2 RAN Inefficiency

The 2G/3G RAN design is not efficient for satellite backhaul. For example, in the GSM Abis interface shown in **Figure G-2**, the resource allocation is on a fixed basis (one or more E1s per BTS), irrespective of the actual traffic. Within the E1, the **T**ime **S**lots (TS) are dedicated to signaling, voice and data per Transceiver (TRX).

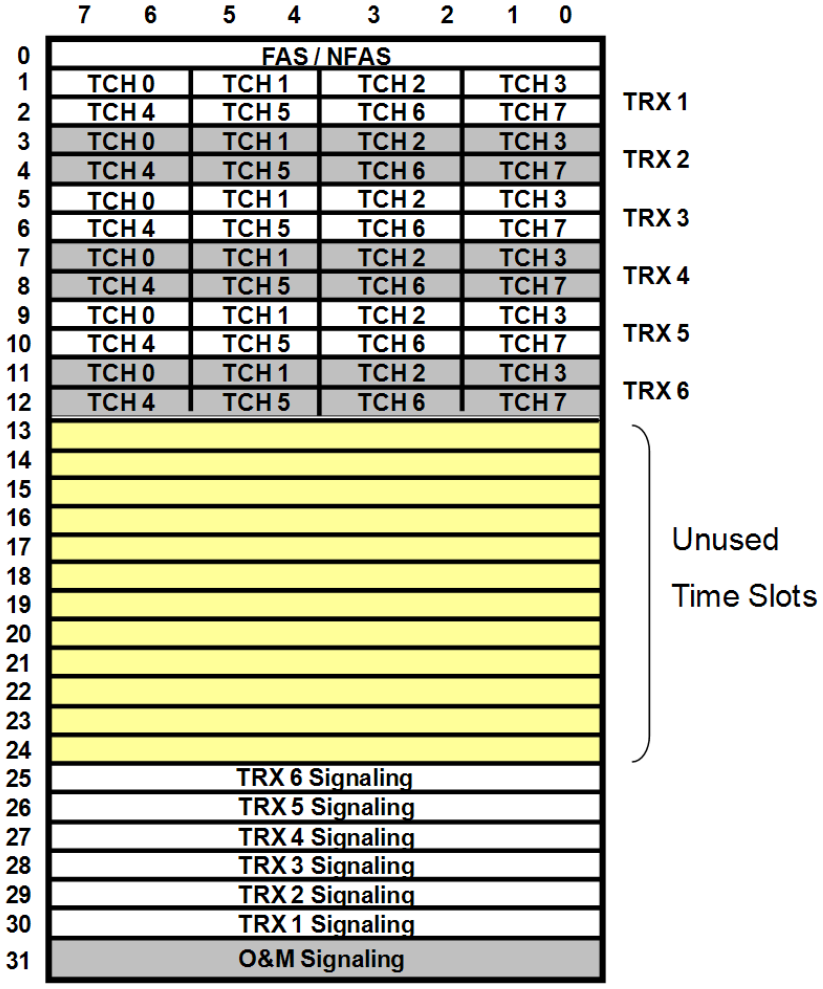


Figure G-2. Typical Abis Map

G.2 E1 RAN Optimization

Jointly developed by Comtech EF Data, CEFD sister division Comtech AHA Corp., and CEFD subsidiary Memotec Inc., RAN Optimization technology significantly reduces the **W**ide **A**rea **N**etwork (WAN) / satellite bandwidth required to carry an E1 bearer used for cellular backhaul.

RAN Optimization allows the transmit modem data rate to be reduced relative to the input terrestrial data rate, thus allowing the transport of a user-selectable channel subset of bearer E1 using less bandwidth. In the receive direction, the data is restored to the E1 format for transport over the G.703 E1 interface.

The process is designed to allow varying levels of optimization to accommodate the incoming terrestrial data in the reduced modem data rate. Optimization performance depends on the traffic profile and the difference between the terrestrial data rate (based on input timeslot selection) and the transmit modem data rate. The optimization is performed in hardware for optimal performance.

The user has complete control over the desired level of optimization by selecting the time slots to be optimized, and the transmit modem data rate. Depending on the traffic profile, typical bandwidth reduction of 30-35% can be achieved with little or no impact to the voice quality.

Users have the option to reduce WAN bandwidth by as much as 60% relative to the ingress data rate – this allows the users to achieve desired bandwidth savings while maintaining desired voice quality.

G.2.1 Process Overview

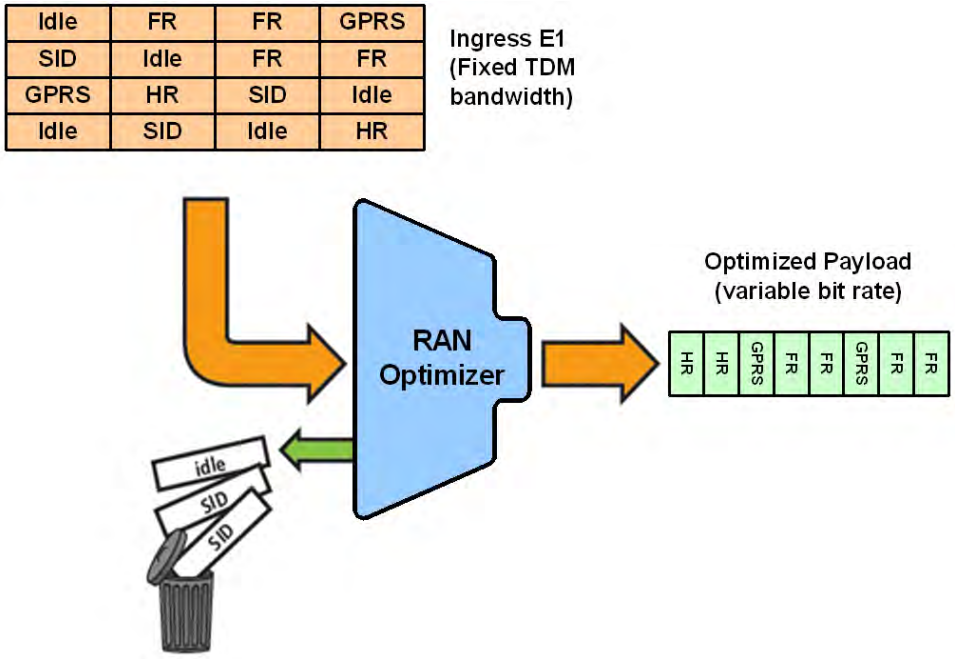


Figure G-3. RAN Optimization (GSM Abis Interface)

On the transmit side, the process for RAN Optimization is summarized as follows:

- The incoming 64 kbps Time Slots are de-multiplexed into Traffic Channels (TCH) ;
- TCH are inspected in real-time to identify Signaling, Voice, Data, and Idle;
- Idle TCH are removed;
- Silence frames are removed from the Voice channel;
- Signaling and Data TCH are compressed using lossless compression;
- O&M frames are compressed using lossless compression;
- Voice frames are compressed using lossless compression;
- Pre-emptive Bandwidth Management to maintain service quality;
- The optimized payload is sent to the modem for transmission.

On the receive side, this process is reversed, re-creating the E1 for transmission over the G.703 E1 interface.

G.2.2 WAN Link Dimensioning and Pre-emptive Bandwidth Management

RAN traffic varies over time – variations during the day that peak at certain time(s), and longer term variation as user density/profile(s) changes. The WAN link can be dimensioned to accommodate the peak traffic, or it can be dimensioned to meet a statistically derived value (e.g. average traffic).

Dimensioning the WAN link for peak traffic may not be economically viable. However, dimensioning the WAN link for average traffic has its challenges. Specifically: What happens when the optimized traffic exceeds WAN capacity?

Typical of most other vendors' RAN optimization solutions, **Figure G-4** shows the optimized Abis traffic as a function of time, depending on the BTS traffic load. The red line is the pre-defined WAN link capacity (assuming 35% target optimization). Each time the optimized Abis traffic exceeds WAN capacity, packets are dropped and the voice quality degrades dramatically – even leading to dropped calls or in the worst case, causing BTS drop.

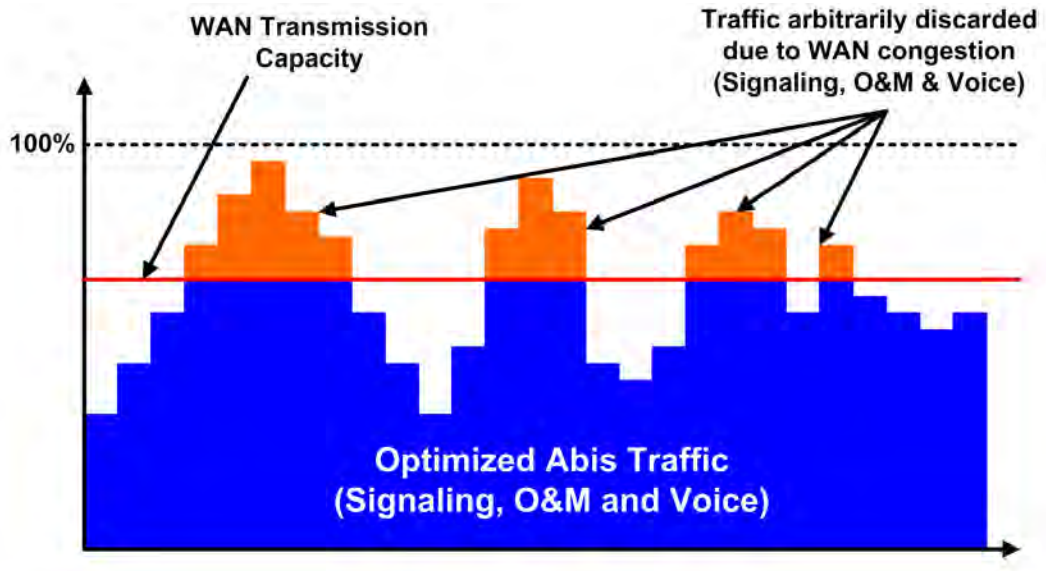


Figure G-4. Optimized Abis Traffic *without* Pre-emptive BW Management

The simplistic packet drop employed by most vendors in case of WAN congestion has potentially disastrous effects on voice quality and call handling – the results can include clicks, blank calls, and eventually call drops, especially if the BCCH channel of the TRX is impacted. In the worst case, it may even lead to BTS drop.

To compensate, most other vendor solutions are forced to over-dimension the WAN link, which leads to significant inefficiencies. *This methodology should not be acceptable to mobile operators.* A good RAN optimization solution should be nearly transparent, and should provide the same level of service to the mobile customers as when there is no RAN Optimization *while* providing a significant reduction in RAN transmission bandwidth.

As implemented by Comtech EF Data, the superior method of handling WAN congestion is to perform pre-emptive and selective voice packet discard. Comtech EF Data's RAN Optimization solution employs a sophisticated bandwidth management capability to maintain *Service Quality*. The signaling and O&M traffic is always protected from being dropped in case of WAN congestion – this ensures that the BTS/NodeB stays connected and synchronized. The bandwidth manager smoothes peak traffic variation before the optimized RAN traffic reaches the available WAN capacity – this mechanism maintains good voice quality while effectively reaching the optimal target optimization rate.

Comtech EF Data's patent pending algorithm on voice packet discard is designed to minimize the impact on the voice quality. This results in superior voice quality and improved *Service Quality* even at peak hour traffic load. Implementing a RAN optimization solution without such capability serves little purpose.

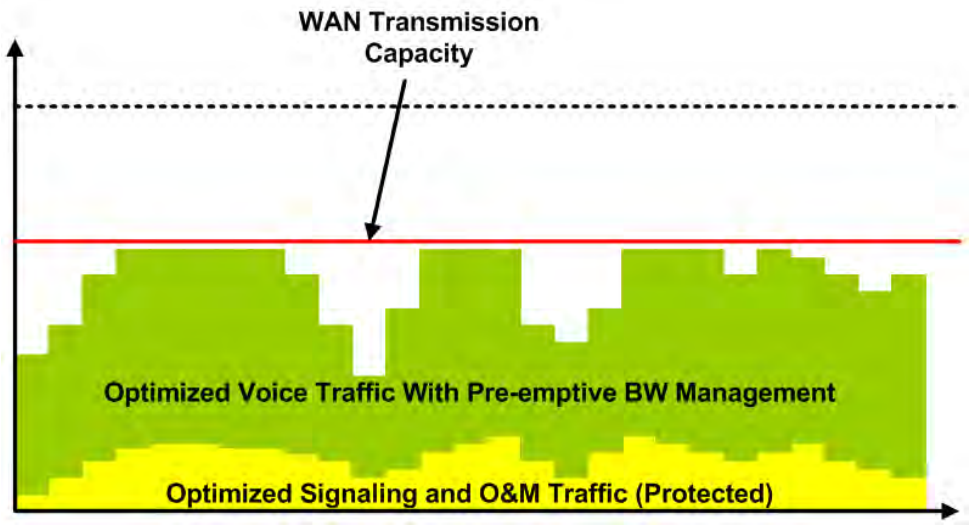


Figure G-5. Optimized Abis Traffic *with* Pre-emptive BW Management

G.2.3 Performance Monitoring

The RAN Optimizer collects detailed usage and performance statistics that are accessible using the CDM-840 Web Server (HTTP) Interface **Status | Statistics | Trending** page (**Figure G-6**). Viewable by selectable time spans, these graphs display information needed to monitor the link performance and to take appropriate action as needed.

See* Chapter 6. ETHERNET-BASED REMOTE PRODUCT MANAGEMENT *for more information about the CDM-840 Web Server (HTTP) Interface and use of the* 'Status | Statistics | Trending' *page.

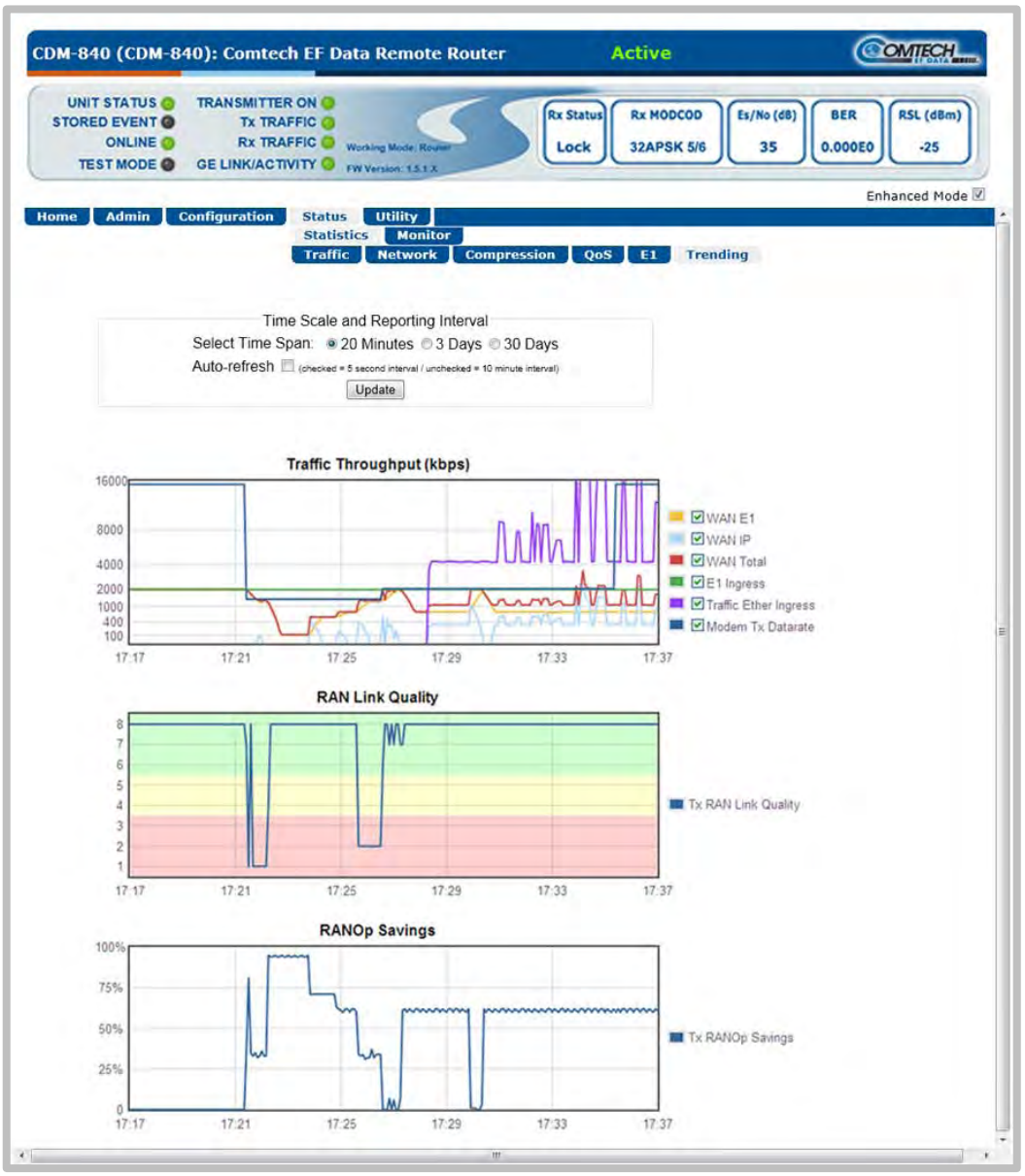
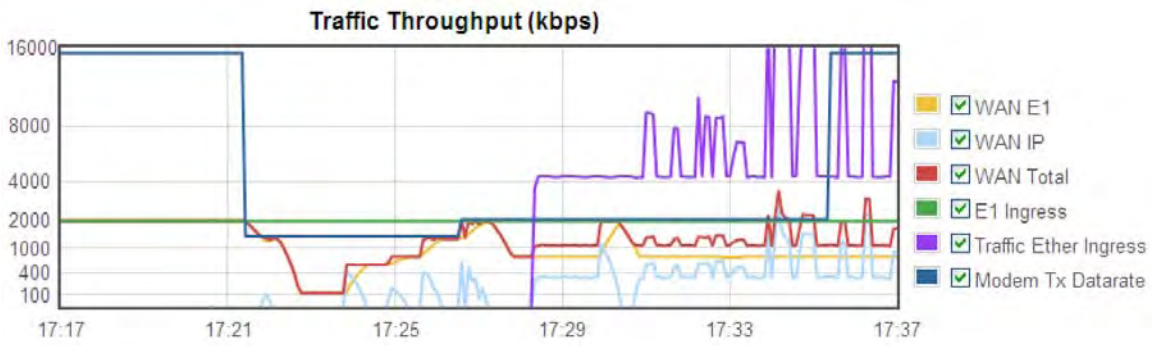


Figure G-6. Status | Statistics | Trending Page

G.2.3.1 Traffic Throughput (kbps)

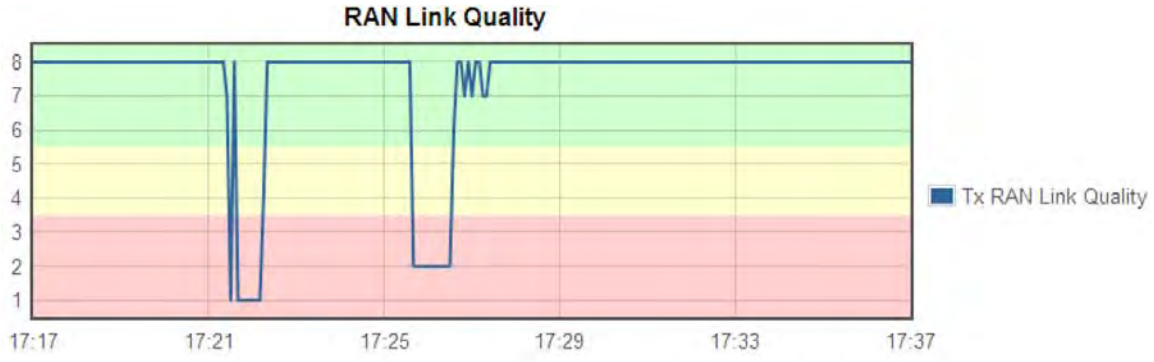


This graph illustrates the utilization of all available data traffic types over a 20-minute, 3-day, or 30-day time span (this example shows the graph with the 20-minute time span selected).

Note the following:

Type	Description
WAN E1	WAN data rate associated with E1/RAN traffic
WAN IP	WAN data rate associated with IP traffic
WAN Total	WAN data rate total (WAN E1 + WAN IP)
E1 Ingress	Data rate of E1 time slots carried (64K * number of time slots)
Traffic Ether Ingress	Data rate of Ethernet traffic
Modem Tx Datarate	Modem transmit data rate

G.2.3.2 RAN Link Quality



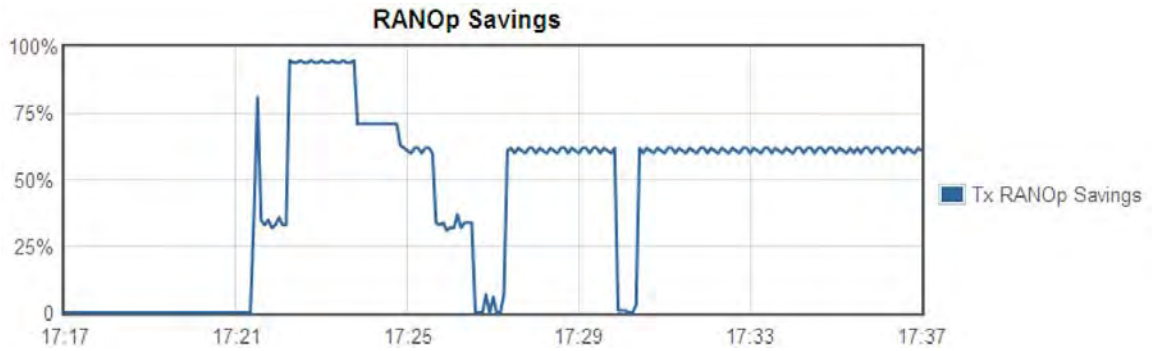
This graph illustrates the performance indicator for the Tx RAN Link Quality metric, a qualitative measure of the voice quality predicated by a) the level of compression, and b) voice packet discard required to accommodate the incoming traffic into the available WAN (satellite) bandwidth. The display is selectable for a 20-minute, 3-day, or 30-day time span (this example shows the graph with the 20-minute time span selected).

Association of the Link Quality Metric to its comparative Link Quality is as follows:

Link Quality Metric	Link Quality
8	Excellent
7	Very Good
6	Good
5	Fair
4	Average
3	Poor
2	Very Poor
1	

Note that '8' on the graph indicates the highest quality, with no voice traffic discard.

G.2.3.3 RANOp Savings



This graph illustrates the performance indicator for Tx RAN Optimization on an actual "percentage of savings" basis over a 20-minute, 3-day, or 30-day time span (this example shows the graph with the 20-minute time span selected).

Notes:

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